

Arizona Department of Transportation

**Materials Sampling, Field Testing
and Laboratory Testing Plan**

SPS-2 Experimental Projects

FINAL

**Federal Aid Project No. IR-10-2(146)
Ehrenberg-Phoenix State Highway
Maricopa County
Arizona**

January 8, 1993

Table of Contents

	<u>Page</u>
List of Tables	iii
List of Figures	v
Background	1
Sampling and Testing of SPS-2 Test Sections	1
Referenced Documents	2
Test Section Layout	4
Overview of Sampling and Testing	11
Subgrade	16
<i>Thin-Wall (Shelby) Tube Samples</i>	16
<i>Bulk Samples</i>	16
<i>Density and Moisture Measurements</i>	16
<i>Plate Bearing Tests</i>	17
<i>Auger Probes</i>	17
Dense Graded Aggregate Base	24
<i>Bulk Samples</i>	24
<i>Plate Bearing Tests</i>	24
<i>Density and Moisture Measurements</i>	24
Permeable Bituminous Treated Base	29
<i>Bulk Samples</i>	29
<i>Plate Bearing Tests</i>	29
<i>Cores</i>	29
Bituminous Treated Base	32
<i>Bulk Samples</i>	32
<i>Cores</i>	32
<i>Density Measurements</i>	32
<i>Plate Bearing Tests</i>	32
Asphalt Concrete Surface	
<i>Bulk Samples</i>	35
<i>Cores</i>	35
<i>Density Measurements</i>	35

Table of Contents (Contd.)

Lean Concrete Base	42
<i>As-Delivered</i>	42
<i>As-Placed</i>	42
Portland Cement Concrete	43
<i>As-Delivered</i>	43
<i>As-Placed</i>	43
Elevation Measurements	55
Summary of Sampling and Testing Quantities	64
Sampling and Testing Summary by Test Section	72

List of Tables

	<u>Page</u>
Table 1. Test section locations and attributes, SPS-2 Arizona.	6
Table 2. Test section location table showing construction and project stations	8
Table 3. Field and laboratory test plan for subgrade materials, SPS-2 Arizona	18
Table 4. Locations for thin wall (Shelby) tube sampling of subgrade, SPS-2 Arizona.	19
Table 5. Locations of prepared subgrade bulk sampling, SPS-2 Arizona.	20
Table 6. Locations for in-place density and moisture tests on subgrade, SPS-2 Arizona.	21
Table 7. Locations of plate bearing tests on subgrade, SPS-2 Arizona.	23
Table 8. Locations of 20' deep shoulder probes, SPS-2 Arizona.	23
Table 9. Field and laboratory test plan for Dense Graded Aggregate Base materials, SPS-2 Arizona.	25
Table 10. Bulk sampling of uncompacted Dense Graded Aggregate Base, SPS-2 Arizona.	26
Table 11. Locations for plate bearing tests on Dense Graded Aggregate Base, SPS-2 Arizona.	26
Table 12. Locations for in-place density and moisture tests on Dense Graded Aggregate Base, SPS-2 Arizona.	27
Table 13. Field and laboratory test plan for Permeable Bituminous Treated Base SPS-2 Arizona.	30
Table 14. Locations for plate bearing tests on Permeable Asphalt Treated Base, SPS-2 Arizona.	31
Table 15. Field and laboratory test plan for Bituminous Treated Base, SPS-2 Arizona	33
Table 16. Locations for in-place density measurements on compacted Bituminous Treated Base, SPS-2 Arizona.	34

List of Tables

	<u>Page</u>
Table 17. Locations of plate bearing tests on Bituminous Treated Base, SPS-2 Arizona.	34
Table 18. Field sampling and laboratory test plan for Asphalt Concrete surface materials, SPS-2 Arizona.	37
Table 19. Asphalt Concrete core locations, SPS-2 Arizona	39
Table 20. Locations for cores of the Asphalt Concrete for the SHRP Materials Reference Library, SPS-2 Arizona.	40
Table 21. Locations for in-place density measurements on compacted Asphalt Concrete, SPS-2 Arizona.	41
Table 22. Field and laboratory test plan for as-delivered Lean Concrete Base and PCC materials, SPS-2 Arizona.	45
Table 23. Bulk samples and molded specimens from Lean Concrete Base, SPS-2 Arizona.	46
Table 24. Bulk samples and molded specimens from PCC mix, SPS-2 Arizona	47
Table 25. Field and laboratory test plan for as-placed LCB and PCC materials, SPS-2 Arizona.	48
Table 26. PCC and bound base core locations, SPS-2 Arizona SPS-2 Arizona.	49
Table 27. Elevation survey locations, SPS-2 Arizona	56
Table 28. Estimated quantities of laboratory materials testing, SPS-2 Arizona.	65
Table 29. Estimated laboratory testing quantities, Lean Concrete Base and PCC molded samples, SPS-2 Arizona.	69
Table 30. Estimated quantities for laboratory materials testing on cores of lean concrete base and portland cement concrete for SPS-2 Arizona.	70
Table 31. Estimated quantities for material sampling and other field tests.	71

List of Figures

		<u>Page</u>
Figure 1.	Layout of experimental test sections, Arizona SPS-2 project, I-10.	5
Figure 2.	Overview of material sampling and testing on prepared subgrade, SPS-2 Arizona.	12
Figure 3.	Overview of material sampling and testing on Dense Graded Aggregate Base, SPS-2 Arizona.	13
Figure 4.	Overview of sampling and testing of Permeable Bituminous Treated Base, Bituminous Treated Base, and Lean Concrete Base, SPS-2 Arizona.	14
Figure 5.	Overview of sampling, testing, and coring plan for surface of test sections on SPS-2 Arizona project.	15
Figure 6.	Sampling and test plan for test section 040261 (AZ24), SPS-2 Arizona.	73
Figure 7.	Sampling and test plan for test section 040214, SPS-2 Arizona.	74
Figure 8.	Sampling and test plan for test section 040222, SPS-2 Arizona.	75
Figure 9.	Sampling and test plan for test section 040218, SPS-2 Arizona.	76
Figure 10.	Sampling and test plan for test section 040220, SPS-2 Arizona.	77
Figure 11.	Sampling and test plan for test section 040224, SPS-2 Arizona.	78
Figure 12.	Sampling and test plan for test section 040216, SPS-2 Arizona	79
Figure 13.	Sampling and test plan for test section 040215, SPS-2 Arizona.	80
Figure 14.	Sampling and test plan for test section 040223, SPS-2 Arizona.	81
Figure 15.	Sampling and test plan for test section 040219, SPS-2 Arizona.	82
Figure 16.	Sampling and test plan for test section 040217, SPS-2 Arizona.	83
Figure 17.	Sampling and test plan for test section 040221, SPS-2 Arizona.	84
Figure 18.	Sampling and test plan for test section 040213, SPS-2 Arizona.	85
Figure 19.	Sampling and test plan for test section 040253 (B31), SPS-2 Arizona. .	86

List of Figures

	<u>Page</u>
Figure 20. Sampling and test plan for test section 040254 (B35), SPS-2 Arizona. .	87
Figure 21. Sampling and test plan for test section 040255 (B36), SPS-2 Arizona. .	88
Figure 22. Sampling and test plan for test section 040256 (B32), SPS-2 Arizona. .	89
Figure 23. Sampling and test plan for test section 040257 (AZ21), SPS-2 Arizona.	90
Figure 24. Sampling and test plan for test section 040258 (AZ22), SPS-2 Arizona.	91
Figure 25. Sampling and test plan for test section 040259 (AZ23), SPS-2 Arizona.	92
Figure 26. Sampling and test plan for test section 040260 (AZ24), SPS-2 Arizona.	93

Materials Sampling, Field Testing and Laboratory Testing Plan SPS-2 Experimental Project

Ehrenberg-Phoenix Highway, Maricopa County, Arizona

This document presents a materials and sampling plan for the experimental Long Term Pavement Performance (LTPP) Program SPS-2 project planned for construction on the Ehrenberg-Phoenix project, Federal Aid Project No. IR-10-2(146), in Maricopa County, Arizona.

Background

The LTPP SPS-2 experiment entitled, "Strategic Study of Structural Factor for Rigid Pavements", consists of the construction of 12 test sections with varying thickness, lane width, portland cement concrete (PCC) strength, and base type. Seven supplemental test sections, designed by Arizona DOT, will be constructed on this project. These supplemental test sections will include skewed jointed PCC sections, and PCC sections with an AC base material layer. In addition, one section will include Arizona's standard pavement design for this project. Material sampling, field tests, and laboratory tests procedures developed by the Strategic Highway Research Program (SHRP) must be followed for the experimental test sections constructed on this project.

Sampling and Testing of SPS-2 Test Sections

Material sampling and testing on this project during construction includes the following measurements, tests and samples from the various pavement layers:

Subgrade

- Bulk sampling and thin-walled tube sampling of the prepared subgrade surface.
- Moisture and density tests on the prepared subgrade surface.
- Plate bearing tests.
- Auger probes through the shoulder to a depth of 20' below the prepared subgrade or embankment surface.
- Base line elevation surveys on the surface of the prepared subgrade or embankment to use as a reference in determining layer thickness.

Dense Graded Aggregate Base

- Bulk sampling of the Dense Graded Aggregate Based (DGAB).
- Moisture and density tests on the prepared DGAB surface.
- Plate bearing tests on the prepared DGAB surface.
- Elevation measurements on the prepared DGAB surface.

Lean Concrete Base

- Bulk sampling and molding of cylindrical test specimens from the as-delivered Lean Concrete Base (LCB) material.
- Plate bearing tests on the LCB surface.
- Coring of the LCB for laboratory testing.
- Elevation measurements on the prepared LCB surface.

Permeable Bituminous Treated Base

- Bulk sampling of the Permeable Bituminous Treated Base (PBTB) material.
- Plate bearing tests on the surface of the PBTB.
- Coring of the PBTB for laboratory testing.
- Elevation measurements on the prepared PBTB surface.

Bituminous Treated Base

- Bulk sampling of the Bituminous Treated Base (BTB) material.
- Coring of the BTB for laboratory testing.
- Elevation measurements on the prepared BTB surface.

Asphalt Concrete Surface

- Bulk sampling of the Asphalt Concrete (AC) material.
- Coring of the AC for laboratory testing.
- Density test on prepared AC surface.
- Elevation measurements on the prepared AC surface.

Portland Cement Concrete

- Bulk sampling and molding of PCC specimens for laboratory testing.
- Slump, air content and temperature measurements on the as-delivered PCC mix.
- Coring of the PCC surface for laboratory testing.
- Elevation measurements on the finished PCC surface.

The development of the materials sampling plan was based upon an assumed continuous construction sequence. Significant time delays between the construction of the test sections may require changes to this sampling plan.

Referenced Documents

In addition to the appropriate AASHTO and ASTM standards methods and tests referenced in this document, the following SHRP-LTPP documents serve as reference material which contain greater details on the sampling and testing requirements and data forms.

SHRP-LTPP Interim Guide for Laboratory Material Handling and Testing (PCC, Bituminous Materials, Aggregates and Soils), Operational Guide No. SHRP-LTPP-OG-004, Strategic Highway Research Program, November, 1989, (Revised January, 1992).

Specific Pavement Studies, Materials and Testing Requirements for Experiment SPS-2, Strategic Study of Structural Factors for Rigid Pavements, Operational Memorandum No. SHRP-LTPP-OM-022, Strategic Highway Research Program, April, 1991.

SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling, Version 2.0, Operational Guide No. SHRP-LTPP-OG-006, Strategic Highway Research Program, May 1990.

Specific Pavement Studies, Construction Guidelines for Experiment SPS-2, Strategic Study of Structural Factors for Rigid Pavements, Operational Memorandum No. SHRP-LTPP-OM-018, Strategic Highway Research Program, December, 1990.

Since this project will include supplemental asphalt concrete surfaced test sections, these test sections will be sampled and tested in following the SHRP-LTPP guidelines for SPS-1 projects. The applicable reference document for these test sections is:

Specific Pavement Studies, Materials Sampling and Testing Requirements for Experiment SPS-1, Strategic Study of Structural Factors for Flexible Pavements, Operational Memorandum No. SHRP-LTPP-OM-021, Strategic Highway Research Program, February, 1991.

Data forms and instructions for all field sampling and measurements described in this document are contained in "Specific Pavement Studies, Materials Sampling and Testing Requirements for Experiment SPS-2, Strategic Study of Structural factors for Rigid Pavements" for the PCC surface test sections and "Specific Pavement Studies, Materials Sampling and Testing Requirements for Experiment SPS-1, Strategic Study of Structural Factors for Flexible Pavements" for the AC surface test sections. These data forms must be completed at the time of the work. Completed forms shall be submitted to the designated LTPP representative.

Test Section Layout

Figure 1 illustrates the ordering and combination of experimental test section pavement structures to be constructed. Construction stations are shown in this figure. Stylized transitions in the pavement structure are shown between the test sections. Transition details will depend upon construction sequence and practice.

The stationing for the location of the test sections are shown in Tables 1 and 2. In these tables the six digit test section number and the LTPP and Arizona test section numbers are shown. The six digit number is the official test section number for use on all data forms. The last two numbers of the six digit number correspond to the LTPP test section designation. The Arizona test section numbers are the same as those shown on the construction plans. In Table 1 the location of each section is specified in terms of the project's construction stationing. The relevant design features of each test section are shown in this table.

In Table 2, the location of each test section is specified in terms of the construction stationing, test section stationing, and LTPP reference project stations. Construction stations are the same as those shown on the construction plans. Test section stationing refers to the method LTPP uses to reference locations within and adjacent to the ends of individual test sections. The LTPP test section stations start with station 0+00 assigned to the beginning of the 500' monitoring portion of the test section, and station 5+00 at the end of the monitoring portion. The LTPP reference project station is a continuous stationing system that starts from the beginning of the monitoring portion of the first test section encountered on the project. The reference stationing system will be used by LTPP for future monitoring measurements.

In general, all sampling of compacted material should occur at the ends of the test section between the start of the test section and the start of the monitoring portion, or between the end of the monitoring portion and the end of the test section. The only samples and tests performed within the 500 feet monitoring portion are plate bearing tests, sampling of the subgrade material, elevation measurements and nuclear moisture-density tests.

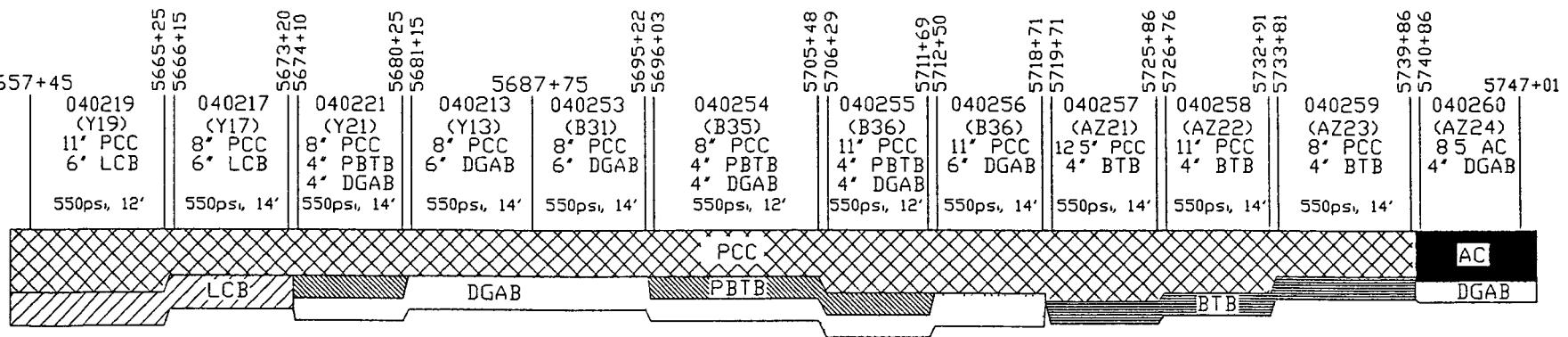
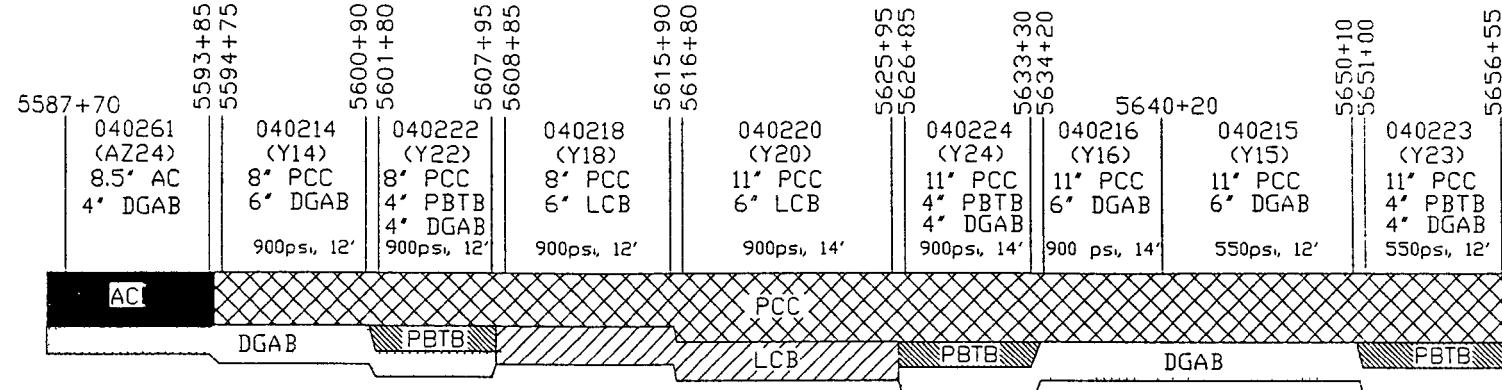


Figure 1. Layout of experimental test sections, Arizona SPS-2 project, I-10.

Table 1. Test section locations and attributes, SPS-2 Arizona.

Section No.	Start Section	Start Monitor	End Monitor	End Section	Notes
040261 (AZ24)	5587+70	5588+20	5593+20	5593+85	8.5"AC\4"DGAB
Trans	5593+85			5594+75	
040214 (Y14)	5594+75	5595+25	5600+25	5600+90	12'\DGAB\8"\900#\D
Trans	5600+90			5601+80	
040222 (Y22)	5601+80	5602+30	5607+30	5607+95	12'\PBTB\8"\900#\D
Trans	5607+95			5608+85	
040218 (Y18)	5608+85	5609+80	5614+80	5615+90	12'\LCB\8"\900#\D
Trans	5615+90			5616+80	
040220 (Y20)	5616+80	5620+30	5625+30	5625+95	14'\LCB\11"\900#\D
Trans	5625+95			5626+85	
040224 (Y24)	5626+85	5627+50	5632+50	5633+30	14'\PBTB\11"\900#\D
Trans	5633+30			5634+20	
040216 (Y16)	5634+20	5634+70	5639+70	5640+20	14'\DGAB\11"\900#\D
Trans	5640+20			5640+20	
040215 (Y15)	5640+20	5644+45	5649+45	5650+10	12'\DGAB\11"\550#\D
Trans	5650+10			5651+00	
040223 (Y23)	5651+00	5651+50	5656+50	5657+15	12'\PBTB\11"\550#\D
Trans	5657+15			5658+05	
040219 (Y19)	5658+05	5659+15	5664+15	5665+25	12'\LCB\11"\550#\D
Trans	5665+25			5666+15	
040217 (Y17)	5666+15	5667+10	5672+10	5673+20	14'\LCB\8"\550#\D
Trans	5673+20			5674+10	
040221 (Y21)	5674+10	5674+60	5679+60	5680+25	14'\PBTB\8"\550#\D
Trans	5680+25			5681+15	
040213 (Y13)	5681+15	5681+95	5686+95	5687+75	14'\DGAB\8"\550#\D
Trans	5687+75			5687+75	
040253 (B31)	5687+75	5689+00*	5694+00	5695+22	14'\DGAB\8"\550#\UD
Trans	5695+22			5696+03	
040254 (B35)	5696+03	5699+00*	5704+00	5705+48	14'\PBTB\8"\550#\UD
Trans	5705+48			5706+29	
040255 (B36)	5706+29	5706+49*	5711+49	5711+69	12'\PBTB\11"\550#\UD
Trans	5711+69			5712+50	
040256 (B32)	5712+50	5713+00*	5718+00	5718+71	12'\DGAB\11"\550#\UD
Trans	5718+71			5719+71	

Table 1. Test section locations and attributes, SPS-2 Arizona (Contd.).

Section No.	Start Section	Start Monitor	End Monitor	End Section	Notes
040257 (AZ21)	5719+71	5720+00*	5725+00	5725+86	14'\BTB\12.5"\550#\D
Trans	5725+86			5726+76	
040258 (AZ22)	5726+76	5727+00*	5732+00	5732+91	14'\BTB\11"\550#\D
Trans	5732+91			5733+81	
040259 (AZ23)	5733+81	5734+00*	5739+00	5739+86	14'\BTB\8"\550#\D
Trans	5739+86			5740+86	
040260 (AZ24)	5740+86	5741+36	5746+36	5747+01	8.5"AC\4"DGAB

Key to Notes:

- DGAB - Dense Graded Aggregate Base
- BTB - Bituminous Treated Base
- LCB - Lean Concrete Base
- PBTB - Permeable Bituminous Treated Base
- AC - Asphalt Concrete
- 8" or 11" - PCC surface thickness, inches.
- 550# or 900# - design flexural strength for PCC mix, psi.
- 14' or 12' - outside lane width, feet.
- D or UD - Doweled or Undoweled joints
- * Location used for base and subgrade sampling and testing. Due to sequenced joint spacings, actual location will depend on constructed joint spacing sequence.

Table 2. Test section location table showing construction and project stations, SPS-2 Arizona.

Test Section	Location	Construction Stationing	Test Section Stationing	LTPP Reference Project Station
040261 (AZ24)	Begin	5587+70	0-50	
	Begin Monitoring	5588+20	0+00	0+00
	End Monitoring	5593+20	5+00	5+00
	End	5593+85	5+65	5+65
040214 (Y14)	Begin	5594+75	0-50	6+55
	Begin Monitoring	5595+25	0+00	7+05
	End Monitoring	5600+25	5+00	12+05
	End	5600+90	5+65	12+70
040222 (Y22)	Begin	5601+80	0-50	13+60
	Begin Monitoring	5602+30	0+00	14+10
	End Monitoring	5607+30	5+00	19+10
	End	5607+95	5+65	19+75
040218 (Y18)	Begin	5608+85	0-95	20+65
	Begin Monitoring	5609+80	0+00	21+60
	End Monitoring	5614+80	5+00	26+60
	End	5615+90	6+10	27+70
040220 (Y20)	Begin	5616+80	-3-50	28+60
	Begin Monitoring	5620+30	0+00	32+10
	End Monitoring	5625+30	5+00	37+10
	End	5625+95	5+65	37+75
040224 (Y24)	Begin	5626+85	0-65	38+65
	Begin Monitoring	5627+50	0+00	39+30
	End Monitoring	5632+50	5+00	44+30
	End	5633+30	5+80	45+10
040216 (Y16)	Begin	5634+20	0-50	46+00
	Begin Monitoring	5634+70	0+00	46+50
	End Monitoring	5639+70	5+00	51+50
	End	5640+20	5+50	52+00
040215 (Y15)	Begin	5640+20	-4-25	52+00
	Begin Monitoring	5644+45	0+00	56+25
	End Monitoring	5649+45	5+00	61+25
	End	5650+10	5+65	61+90

Table 2. Test section location table showing construction and project stations, SPS-2 Arizona (Contd.).

Test Section	Location	Construction Stationing	Test Section Stationing	LTPP Reference Project Station
040223 (Y23)	Begin	5651+00	0-50	62+80
	Begin Monitoring	5651+50	0+00	63+30
	End Monitoring	5656+50	5+00	68+30
	End	5657+15	5+65	68+95
040219 (Y19)	Begin	5658+05	-1-10	69+85
	Begin Monitoring	5659+15	0+00	70+95
	End Monitoring	5664+15	5+00	75+95
	End	5665+25	6+10	77+05
040217 (Y17)	Begin	5666+15	0-95	77+95
	Begin Monitoring	5667+10	0+00	78+90
	End Monitoring	5672+10	5+00	83+90
	End	5673+20	6+10	85+00
040221 (Y21)	Begin	5674+10	0-50	85+90
	Begin Monitoring	5674+60	0+00	86+40
	End Monitoring	5679+60	5+00	91+40
	End	5680+25	5+65	92+05
040213 (Y13)	Begin	5681+15	0-80	92+95
	Begin Monitoring	5681+95	0+00	93+75
	End Monitoring	5686+95	5+00	98+75
	End	5687+75	5+80	99+55
040253 (B31)	Begin	5687+75	-1-25	99+55
	Begin Monitoring	5689+00*	0+00	100+80
	End Monitoring	5694+00	5+00	105+80
	End	5695+22	6+22	107+02
040254 (B35)	Begin	5696+03	-2-97	107+83
	Begin Monitoring	5699+00*	0+00	110+80
	End Monitoring	5704+00	5+00	115+80
	End	5705+48	6+48	117+28
040255 (B36)	Begin	5706+29	0-20	118+09
	Begin Monitoring	5706+49*	0+00	118+29
	End Monitoring	5711+49	5+00	123+29
	End	5711+69	5+20	123+49

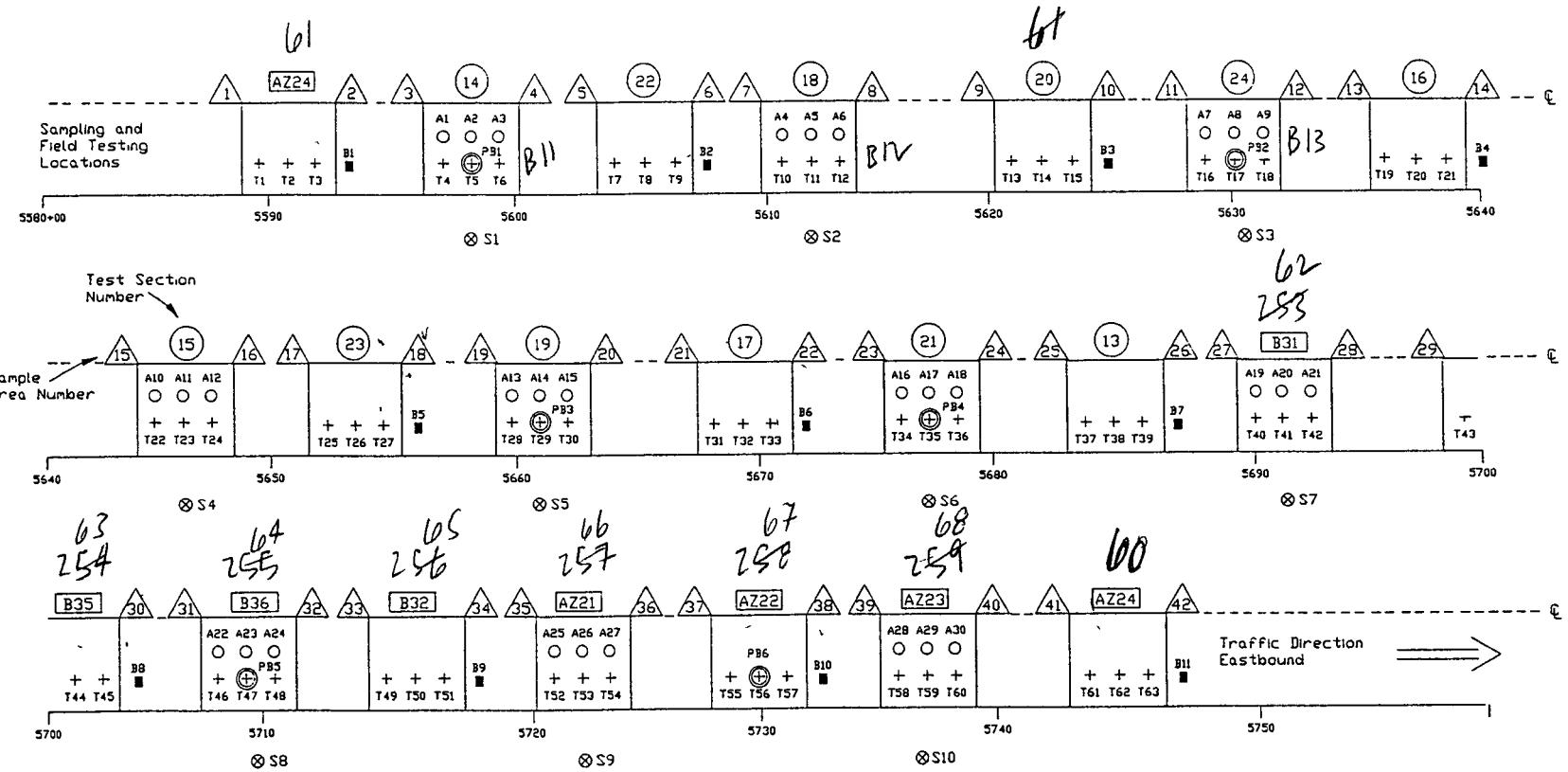
Table 2. Test section location table showing construction and project stations, SPS-2 Arizona (Contd.).

Test Section	Location	Construction Stationing	Test Section Stationing	LTPP Reference Project Station
040256 (B32)	Begin	5712+50	0-50	124+30
	Begin Monitoring	5713+00*	0+00	124+80
	End Monitoring	5718+00	5+00	129+80
	End	5718+71	5+71	130+51
040257 (AZ21)	Begin	5719+71	0-29	131+51
	Begin Monitoring	5720+00*	0+00	131+80
	End Monitoring	5725+00	5+00	136+80
	End	5725+86	5+86	137+66
040258 (AZ22)	Begin	5726+76	0-24	138+56
	Begin Monitoring	5727+00*	0+00	138+80
	End Monitoring	5732+00	5+00	143+80
	End	5732+91	5+91	144+71
040259 (AZ23)	Begin	5733+81	0-19	145+61
	Begin Monitoring	5734+00*	0+00	145+80
	End Monitoring	5739+00	5+00	150+80
	End	5739+86	5+86	151+66
040260 (AZ24)	Begin	5740+86	0-50	152+66
	Begin Monitoring	5741+36	0+00	153+16
	End Monitoring	5746+36	5+00	158+16
	End	5747+01	5+65	158+81

* Location used for base and subgrade sampling and testing. Due to sequenced joint spacings, actual location will depend on constructed joint spacing sequence.

Overview of Sampling and Testing

An overview of the material sampling and testing to be performed on all test section is shown in Figures 2 to 5 for each pavement layer. In these figures, symbols are used to designate the locations for the various types of samples and tests. Bulk samples of concrete materials, including AC, BTB, PBTB, PCC, LCB, are shown for the test sections from which the materials should be obtained during construction.



- 2' x 2' bulk sampling location (B1-B11) to 12' below top of subgrade
 - Shelby tube/splitspoon sampling to 4' below top of prepared subgrade (A1-A30)
 - ⊗ Shoulder probe (S1-S10)
 - + Location of nuclear moisture-density tests (T1-T63)
 - ⊕ Plate bearing tests (PB1-PB6)

Figure 2. Overview of material sampling and testing on prepared Subgrade, SPS-2 Arizona.

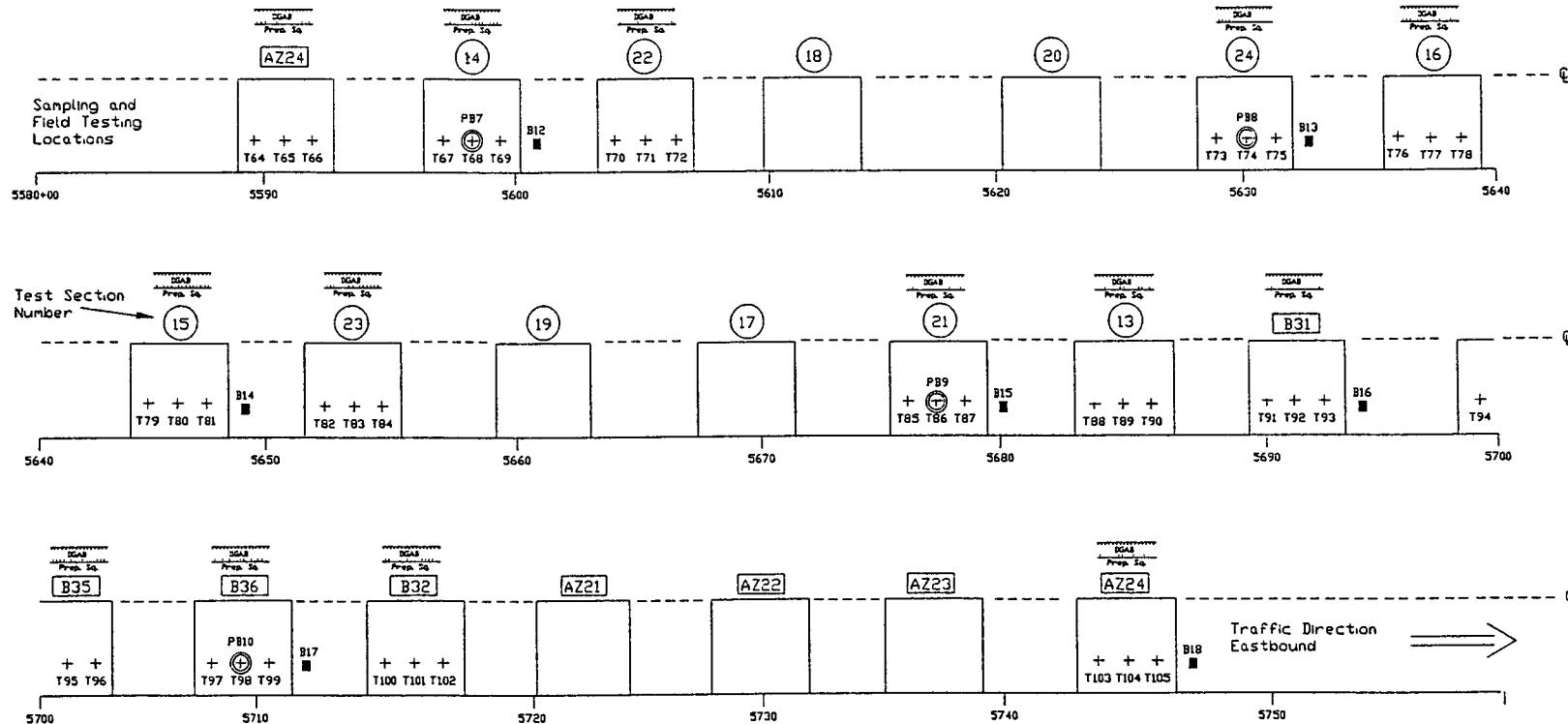
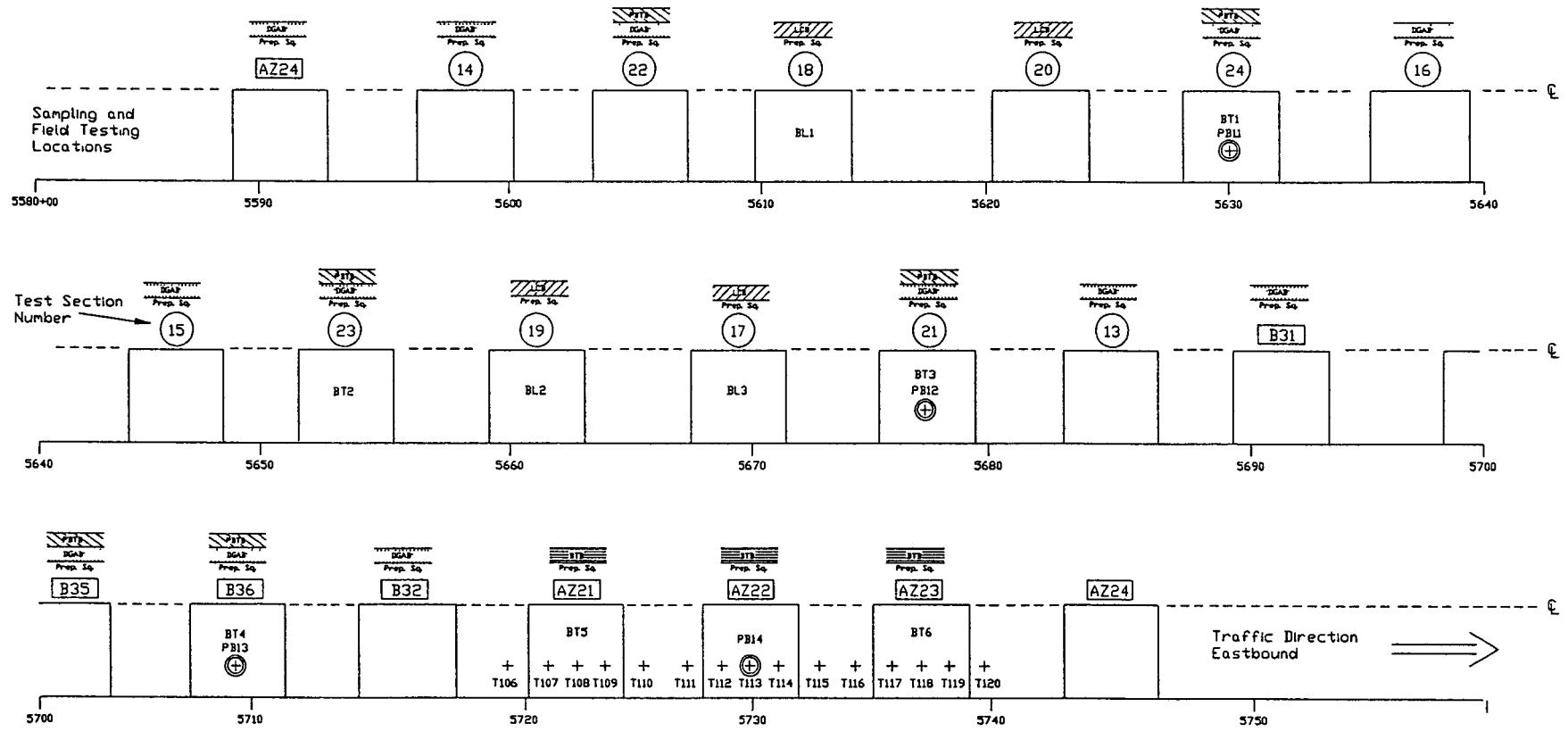


Figure 3. Overview of material sampling and testing on Dense Graded Aggregate Base, SPS-2 Arizona.



- ⊕ Plate bearing tests (PB11-PB14)
- + Locations of nuclear density tests (T106-T120)
- BL1-BL6 - Bulk LCB samples
- BT1-BT4 - Bulk PBTB samples
- BT5-BT6 - Bulk BTB samples

Figure 4. Overview of sampling and testing of Permeable Bituminous Treated Base, Bituminous Treated Base, and Lean Concrete Base, SPS-2 Arizona.

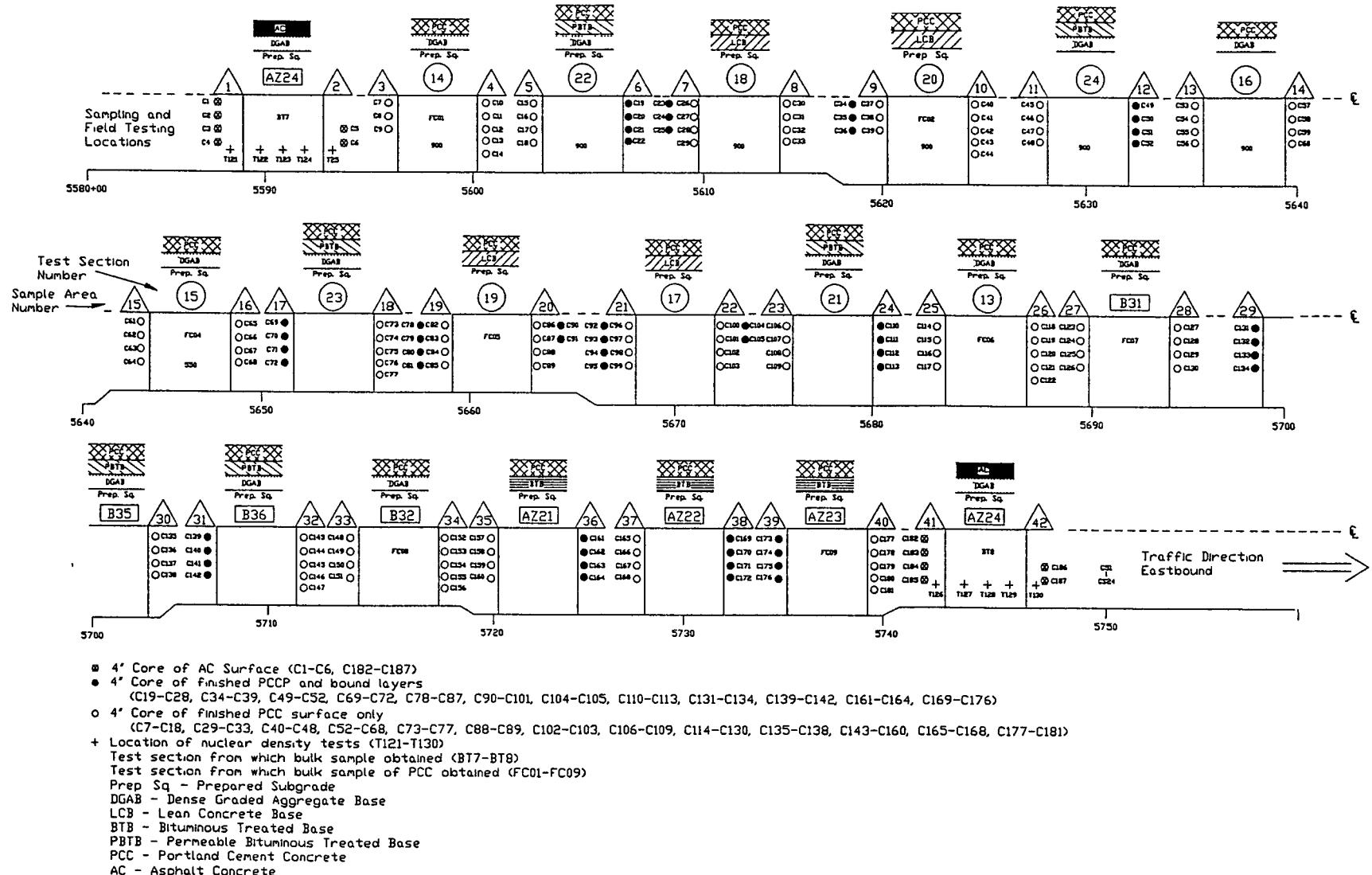


Figure 5. Overview of sampling, testing, and coring plan for surface of test sections on SPS-2 Arizona project.

Subgrade

The subgrade layer measurements, tests and sampling should be performed prior to placement of the base layers. The objective is to characterize the properties of the prepared subgrade surface or embankment fill material immediately prior to the time the base layers are placed. It is therefore desired that the moisture-density tests, thin-walled tube samples, bulk samples, and elevation measurements be performed just prior to the time when the base course is placed. This is important in instances when the prepared subgrade will be left exposed to the elements for a significant period, 2-3 months depending on climatic events, which might influence the properties of the upper layers of the subgrade.

A summary of the samples, laboratory and field test on the subgrade material is presented in Table 3. In this table, B-type samples are bulk samples and A-type samples are thin-wall (Shelby) tube samples of the subgrade materials. The T-type test locations are for nuclear moisture-density tests, and the S-type locations are for the 20 foot deep auger probes through the shoulder.

Thin-wall (Shelby) Tube Samples

Undisturbed samples of the natural subgrade or fill material shall be obtained to a depth of 4' below the top of the prepared subgrade or fill using thin-wall (Shelby) tube sampling at the locations listed in Table 4. Two samples should be obtained at each location. These operations shall be performed in accordance with **AASHTO T203 "Soil Investigation and Sampling by Auger Boring"** and **AASHTO M146 "Terms Relating to subgrade, Soil-Aggregate and Fill Materials"**. Shelby tube sampling shall be performed in accordance with **AASHTO T207**. If Shelby tube samples can not be obtained, split spoon samples should be obtained following Section 3.4.5 of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling.

Bulk Samples

Bulk samples of the subgrade or embankment material should be obtained from the locations listed in Table 5. In general, bulk sampling should consist of a single excavation, 2' by 2' in area and 12 inches deep. Approximately 400 lbs of material should be obtained from each sampling location. The sampling operation should be performed following the procedures contained in Section 3.5 of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling as appropriate. Samples for gravimetric moisture tests should be obtained at each bulk sample location. **In-place density and moisture tests should be obtained at each bulk sampling location prior to sampling operations.**

Density and Moisture Measurements

In-place density and moisture measurements should be performed on the prepared subgrade or embankment material surface at the locations specified in Table 6 and bulk sampling locations shown in Table 5. These test shall be performed using a recently calibrated nuclear moisture-density gauge in accordance with the procedures in **AASHTO T238-86, Method B-**

Direct Transmission, AASHTO T239-86 and ASTM D2950-82. Each measurement shall be the result of the average of four reading made during each 90° rotation of the nuclear gauge through a full 360°.

Plate Bearing Tests

Plate bearing tests should be performed on the surface of the prepared subgrade at the locations specified in Table 7. Plate bearing tests should be performed in accordance with the procedures contained in SHRP-LTPP Protocol P58.

Auger Probes

Auger probes to a depth of 20' from the surface of the prepared subgrade or embankment should be performed at the shoulder locations specified in Table 8. The purpose of these probes is to determine if bedrock or other significantly dense layers exist within 20 feet of the pavement surface elevation. Auguring shall be performed using a truck mounted drill rig using 4 or 6 inch, continuous flight, solid, helical augers.

Table 3. Field and laboratory test plan for Subgrade materials, SPS-2 Arizona.

Test Name	LTPP Test Designation	LTPP Protocol	Number of Tests	Material Source / Test Location
Sieve Analysis	SS01	P51	11	B1 - B11
Hydrometer to 0.01 mm	SS02	P42	11	B1 - B11
Atterberg Limits	SS03	P43	11	B1 - B11
Subgrade Classification and Type	SS04	P52	41	A1 - A30, B1 - B11 (Note 1)
Moisture-Density Relations	SS05	P55	11	B1 - B11
Resilient Modulus	SS07	Ship to FHWA Lab	10	A2, A5, A8, A11, A14, A17, A20, A23, A26, A29
Unit Weight	SS08	P56	30	A1-A30
Natural Moisture Content	SS09	P49	11	B1 - B11
Unconfined Compression Strength	SS10	P54	10	A1, A4, A7, A10, A13, A16, A19, A22, A25, A28
Permeability	SS11	P57	6	B1, B2, B5, B7, B8, B10
In-Place Density		LTPP Method	74	B1-B11, T1-T63
Depth to Rigid Layer		LTPP Method	10	S1-S10
Plate Bearing Testing	SS06	P58	6	PB1-PB6

Note 1. Visual-manual classification method only.

Table 4. Locations for thin-wall (Shelby) tube sampling of Subgrade, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line, Rt	Outside Lane Edge, Lt	
A1	5596+25	4	8	14
A2	5597+75	4	8	14
A3	5599+25	4	8	14
A4	5610+80	4	8	18
A5	5612+30	4	8	18
A6	5613+80	4	8	18
A7	5628+50	4	10	24
A8	5630+00	4	10	24
A9	5631+50	4	10	24
A10	5645+45	4	8	15
A11	5646+95	4	8	15
A12	5648+45	4	8	15
A13	5660+15	4	8	19
A14	5661+65	4	8	19
A15	5663+15	4	8	19
A16	5675+60	4	10	21
A17	5677+10	4	10	21
A18	5678+60	4	10	21
A19	5690+00	4	10	B31
A20	5691+50	4	10	B31
A21	5693+00	4	10	B31
A22	5707+49	4	8	B36
A23	5708+99	4	8	B36
A24	5710+49	4	8	B36
A25	5721+00	4	10	AZ21
A26	5722+50	4	10	AZ21
A27	5724+00	4	10	AZ21
A28	5735+00	4	10	AZ23
A29	5736+50	4	10	AZ23
A30	5738+00	4	10	AZ23

Table 5. Locations of prepared Subgrade bulk sampling, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area
		Center Line, Rt	Outside Lane Edge, Lt		
B1	5593+70	7	5	AZ24	2
B2	5607+80	7	5	22	6
B3	5625+80	7	7	20	10
B4	5640+10	7	7	16	14
B5	5657+00	7	5	23	18
B6	5672+60	7	7	17	22
B7	5687+45	7	7	13	26
B8	5704+50	7	7	B35	30
B9	5718+50	7	5	B32	34
B10	5732+50	7	7	AZ22	38
B11	5746+86	7	5	AZ24	42

Table 6. Locations for in-place density and moisture tests on Subgrade, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line, Rt	Outside Lane Edge, Lt	
T1	5589+20	7	5	AZ24
T2	5590+70	7	5	AZ24
T3	5592+20	7	5	AZ24
T4	5596+25	7	5	14
T5	5597+75	7	5	14
T6	5599+25	7	5	14
T7	5603+30	7	5	22
T8	5604+80	7	5	22
T9	5606+30	7	5	22
T10	5610+80	7	5	18
T11	5612+30	7	5	18
T12	5613+80	7	5	18
T13	5621+30	7	7	20
T14	5622+80	7	7	20
T15	5624+30	7	7	20
T16	5628+50	7	7	24
T17	5630+00	7	7	24
T18	5631+50	7	7	24
T19	5635+70	7	7	16
T20	5637+20	7	7	16
T21	5638+70	7	7	16
T22	5645+45	7	5	15
T23	5646+95	7	5	15
T24	5648+45	7	5	15
T25	5652+50	7	5	23
T26	5654+00	7	5	23
T27	5655+50	7	5	23
T28	5660+15	7	5	19
T29	5661+65	7	5	19
T30	5663+15	7	5	19
T31	5668+10	7	7	17

Table 6. Locations for in-place density and moisture tests on Subgrade, SPS-2 Arizona (Contd).

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line, Rt	Outside Lane Edge, Lt	
T32	5669+60	7	7	17
T33	5671+10	7	7	17
T34	5675+60	7	7	21
T35	5677+10	7	7	21
T36	5678+60	7	7	21
T37	5682+95	7	7	13
T38	5684+45	7	7	13
T39	5685+95	7	7	13
T40	5690+00	7	7	B31
T41	5691+50	7	7	B31
T42	5693+00	7	7	B31
T43	5700+00	7	7	B35
T44	5701+50	7	7	B35
T45	5703+00	7	7	B35
T46	5707+49	7	5	B36
T47	5708+99	7	5	B36
T48	5710+49	7	5	B36
T49	5714+00	7	5	B32
T50	5715+50	7	5	B32
T51	5717+00	7	5	B32
T52	5721+00	7	7	AZ21
T53	5722+50	7	7	AZ21
T54	5724+00	7	7	AZ21
T55	5728+00	7	7	AZ22
T56	5729+50	7	7	AZ22
T57	5731+00	7	7	AZ22
T58	5735+00	7	7	AZ23
T59	5736+50	7	7	AZ23
T60	5738+00	7	7	AZ23
T61	5742+36	7	5	AZ24
T62	5743+86	7	5	AZ24
T63	5745+36	7	5	AZ24

Table 7. Locations of plate bearing tests on Subgrade, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line, Rt	Outside Lane Edge, Lt	
PB1	5597+75	7	5	14
PB2	5630+00	7	7	24
PB3	5661+65	7	5	19
PB4	5677+10	7	7	21
PB5	5708+99	7	5	B36
PB6	5729+50	7	7	AZ22

Table 8. Locations of 20' deep shoulder probes, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line, Rt	Outside Lane Edge, Rt	
S1	5597+75	18	6	14
S2	5612+30	18	6	18
S3	5630+00	18	4	24
S4	5646+95	18	6	15
S5	5661+65	18	6	19
S6	5677+10	18	4	21
S7	5691+50	18	4	B31
S8	5708+99	18	6	B36
S9	5722+50	18	4	AZ21
S10	5736+50	18	4	AZ23

Dense Graded Aggregate Base

The measurements, tests and samples on the Dense Graded Aggregate Base (DGAB) layer should be performed prior to placement of the next pavement layer. The objective is to characterize the properties of the prepared base at the time when the next pavement layer is placed. It is therefore desired that the moisture-density tests and elevation measurements be performed just prior to the time when the next pavement layer is placed. This is most important in instances when the aggregate base will be left exposed to the elements for a significant period, 2-3 months depending on climatic events, which might influence the properties of the material.

A summary of the samples to be taken from the DGAB material and tests to be conducted is presented in Table 9. Only bulk material samples of the DGAB material are taken. Field tests include in-place density and moisture measurements and plate bearing tests.

Bulk Samples

Bulk samples of the DGAB material should be obtained at the approximate locations specified in Table 10. Sampling maybe performed prior to compaction to avoid interruptions to construction activities. Uncontaminated 200 lbs samples shall be obtained from each location. The procedures similar to those contained in section 3.5 of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling should be followed.

Plate Bearing Tests

Plate bearing tests should be performed on the surface of the prepared base at the locations specified in Table 11. Plate bearing tests should be performed in accordance with the procedures contained in LTPP Protocol P58.

Density and Moisture Measurements

Nuclear density and moisture measurements shall be performed on top of the prepared DGAB at the location specified in Table 12. These measurements shall be performed following the same procedures used for subgrade soils.

Table 9. Field and laboratory test plan for Dense Graded Aggregate Base materials, SPS-2 Arizona.

Test Name	LTPP Test Designation	LTPP Protocol	Number of Tests	Material Source / Test Location
Particle Size Analysis	UG01	P41	7	B12-B18
Sieve Analysis (washed)	UG02	P41	7	B12-B18
Atterberg Limits	UG04	P43	7	B12-B18
Moisture-Density Relations	UG05	P44	7	B12-B18
Resilient Modulus	UG07	Ship to FHWA lab	7	B12-B18
Classification	UG08	P47	7	B12-B18
Permeability	UG09	P48	7	B12-B18
Natural Moisture Content	UG10	P49	7	B12-B18
In-Place Density		LTPP Method	42	T64-T105
Plate Bearing Test	SS06	P58	4	PB7-PB10

Table 10. Bulk sampling of uncompacted Dense Graded Aggregate Base, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area
		Center Line, Rt	Outside Lane Edge, Lt		
B12	5600+75	6	6	14	4
B13	5633+00	7	7	24	12
B14	5649+95	6	6	15	16
B15	5680+10	7	7	21	24
B16	5694+50	7	7	B31	28
B17	5711+60	6	6	B36	32
B18	5746+85	6	6	AZ24	42

Table 11. Locations for plate bearing tests on Dense Graded Aggregate Base, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line, Rt	Outside Lane Edge, Lt	
PB07	5597+75	7	5	14
PB08	5630+00	7	7	24
PB09	5677+10	7	7	21
PB10	5708+99	7	5	B36

Table 12. Locations for in-plane density and moisture tests on Dense Graded Aggregate Base, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line, Rt	Outside Lane Edge, Lt	
T64	5589+20	7	5	AZ24
T65	5590+70	7	5	AZ24
T66	5592+20	7	5	AZ24
T67	5596+25	7	5	14
T68	5597+75	7	5	14
T69	5599+25	7	5	14
T70	5603+30	7	5	22
T71	5604+80	7	5	22
T72	5606+30	7	5	22
T73	5628+50	7	7	24
T74	5630+00	7	7	24
T75	5631+50	7	7	24
T76	5635+70	7	7	16
T77	5637+20	7	7	16
T78	5638+70	7	7	16
T79	5645+45	7	5	15
T80	5646+95	7	5	15
T81	5648+45	7	5	15
T82	5652+50	7	5	23
T83	5654+00	7	5	23
T84	5655+50	7	5	23
T85	5675+60	7	7	21
T86	5677+10	7	7	21
T87	5678+60	7	7	21
T88	5682+95	7	7	13
T89	5684+45	7	7	13
T90	5685+95	7	7	13
T91	5690+00	7	7	B31
T92	5691+50	7	7	B31
T93	5693+00	7	7	B31
T94	5700+00	7	7	B35

Table 12. Locations for in-plate density and moisture tests on Dense Graded Aggregate Base, SPS-2 Arizona (Contd.).

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line, Rt	Outside Lane Edge, Lt	
T95	5701+50	7	7	B35
T96	5703+00	7	7	B35
T97	5707+49	7	5	B36
T98	5708+99	7	5	B36
T99	5710+49	7	5	B36
T100	5714+00	7	5	B32
T101	5715+50	7	5	B32
T102	5717+00	7	5	B32
T103	5742+36	7	5	AZ24
T104	5743+86	7	5	AZ24
T105	5745+36	7	5	AZ24

Permeable Bituminous Treated Base

The field and laboratory test plan for the Permeable Bituminous Treated Base (PBTB) materials is presented in Table 13. Sampling of this material includes bulk samples of the uncompacted mix and cores obtained after placement of the PCC surface material. Field tests include only plate bearing tests on the compacted surface.

Bulk Samples

Bulk sampling of the uncompacted mix can be performed at the mix plant to avoid interruptions to construction activities. Care should be taken to obtain the designated samples of the materials to be placed in the test sections shown in Figure 4. If sampling at the mix plant is not feasible, samples should be obtained from the haul vehicle at the test site. These samples shall be obtained in accordance with AASHTO T168 and shipped to the laboratory in suitable containers. Each sample shall consist of 100 lbs of material.

Plate Bearing Tests

Plate bearing tests should be performed on the surface of the prepared PBTB at the locations specified in Table 14 in accordance with LTPP guidelines.

Cores

Cores of the PBTB shall be obtained at the same time the PCC surface material is cored. The locations of the cores are listed in Table 26. The Federal Highway Administration will perform the resilient modulus test and indirect tensile strength test, which is a part of the resilient modulus test, under a separate contract. The cores of the PBTB material must be shipped to the designated FHWA laboratory after the core examination and bulk specific gravity tests have been performed.

Table 13. Field and laboratory test plan for Permeable Bituminous Treated Base, SPS-2 Arizona.

Test Name	SHRP Test Designation	SHRP Protocol	Number of Tests	Material Source / Test Location
Core Examination/Thickness	AC01	P01	24	C19-C22, C49-C52, C69-C72, C110-C113, C131-C134, C139-C142
Bulk Specific Gravity	AC02	P02	24	C19-C22, C49-C52, C69-C72, C110-C113, C131-C134, C139-C142
Maximum Specific Gravity	AC03	P03	4	BT1-BT4
Asphalt Content (Extraction)	AC04	P04	4	BT1-BT4
Moisture Susceptibility	AC05	P05	4	BT1-BT4
Permeability/Flow	AC08	P08	1	BT3
Resilient Modulus	AC07	Ship to FHWA Lab	6	C19-C21, C49-C51, C69-C71, C110-C112, C131-C133, C139-C141
Indirect Tensile Strength	AC07	Ship to FHWA Lab	24	C19-C22, C49-C52, C69-C72, C110-C113, C131-C134, C139-C142
Plate Bearing Test	SS06	P58	3	PB12-PB14
Extracted Aggregate				
Specific Gravity Coarse Aggregate	AG01	P11	1	BT2
Specific Gravity Fine Aggregate	AG02	P12	1	BT2
Type and Class Coarse Aggregate	AG03	P13	1	BT2
Type and Class Fine Aggregate	AG03	P13	1	BT2
Aggregate Gradation	AG04	P14	1	BT2
NAA Test for Fine Aggregate Particle Shape	AG05	P14A	1	BT2
Coarse Aggregate Shape	AG06	P14B	1	BT2
Asphalt Cement				
Abson Recovery	AE01	P21	1	BT2
Penetration at 50F, 77F, 90F	AE02	P22	1	BT2
Specific Gravity (60F)	AE03	P23	1	BT2
Viscosity at 77F	AE04	P24	1	BT2
Viscosity at 140F, 275F	AE05	P25	1	BT2

Table 14. Locations for plate bearing tests on Permeable Asphalt Treated Base, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line, Rt	Outside Lane Edge, Lt	
PB11	5630+00	7	7	24
PB12	5677+10	7	7	21
PB13	5708+99	7	5	B36

Bituminous Treated Base

The field and laboratory test plan for the Bituminous Treated Base (BTB) materials is presented in Table 15. Sampling of this material includes bulk samples of the uncompacted mix and cores obtained after placement of the PCC surface material. Field tests include plate bearing tests and nuclear density tests on the compacted surface.

Bulk Samples

Bulk sampling of the uncompacted mix can be performed at the mix plant to avoid interruptions to construction activities. Care should be taken to obtain the designated samples of the materials to be placed in the test sections shown in Figure 4. If sampling at the mix plant is not feasible, samples should be obtained from the haul vehicle at the test site. These samples shall be obtained in accordance with **AASHTO T168** and shipped to the laboratory in suitable containers. Each sample shall consist of 100 lbs of material.

Cores

Cores of the BTB shall be obtained at the same time the PCC surface material is cored. The locations of the cores listed in Table 26. The Federal Highway Administration will perform the resilient modulus test, and indirect tensile strength test which is a part of the resilient modulus test, under a sperate contract. The cores of the BTB material must be shipped to the designated FHWA laboratory after the core examination and bulk specific gravity tests have been performed.

Density Measurements

Nuclear density measurements shall be performed on top of the prepared BTB at the location specified in Table 16. These measurements shall be performed following the same procedures used for subgrade soils.

Plate Bearing Tests

Plate bearing tests should be performed on the surface of the prepared PBTB at the locations specified in Table 17 in accordance with LTPP guidelines.

Table 15. Field and laboratory test plan for Bituminous Treated Base, SPS-2 Arizona.

Test Name	SHRP Test Designation	SHRP Protocol	Number of Tests	Material Source / Test Location
Core Examination/Thickness	AC01	P01	12	C161-C164, C169-C176
Bulk Specific Gravity	AC02	P02	12	C161-C164, C169-C176
Maximum Specific Gravity	AC03	P03	2	BT5-BT6
Asphalt Content (Extraction)	AC04	P04	2	BT5-BT6
Moisture Susceptibility	AC05	P05	1	BT6
Resilient Modulus	AC07	Ship to FHWA Lab	3	C161-C163, C169-C171, C173-175
Indirect Tensile Strength	AC07	Ship to FHWA Lab	12	C161-C164, C169-C176
In-Place Density		LTPP Method	15	T106-T120
Plate Bearing Test	SS06	P58	1	PB14
Extracted Aggregate				
Specific Gravity Coarse Aggregate	AG01	P11	1	BT6
Specific Gravity Fine Aggregate	AG02	P12	1	BT6
Type and Class Coarse Aggregate	AG03	P13	1	BT6
Type and Class Fine Aggregate	AG03	P13	1	BT6
Aggregate Gradation	AG04	P14	1	BT6
NAA Test for Fine Aggregate Particle Shape	AG05	P14A	1	BT6
Coarse Aggregate Particle Shape	AG06	P14B	1	BT6
Asphalt Cement				
Abson Recovery	AE01	P21	2	BT-5, BT6
Penetration @ 50F, 77F, 90F	AE02	P22	2	BT-5, BT6
Specific Gravity (60F)	AE03	P23	2	BT-5, BT6
Viscosity @ 77F	AE04	P24	2	BT-5, BT6
Viscosity @ 140F, 275F	AE05	P25	2	BT-5, BT6
Asphalt Cement (from plant)				
Penetration @ 50F, 77F, 90F	AE02	P22	2	BC1, BC2
Specific Gravity (60F)	AE03	P23	2	BC1, BC2
Viscosity @ 77F	AE04	P24	2	BC1, BC2
Viscosity @ 104F, 275F	AE05	P25	2	BC1, BC2

Table 16. Locations for in-place density measurements on compacted **Bituminous Treated Base**, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line, Rt	Outside Lane Edge, Lt	
T106	5719+80	7	7	AZ21
T107	5721+00	7	7	AZ21
T108	5722+50	7	7	AZ21
T109	5724+00	7	7	AZ21
T110	5725+45	7	7	AZ21
T111	5726+85	7	7	AZ22
T112	5728+00	7	7	AZ22
T113	5729+50	7	7	AZ22
T114	5731+00	7	7	AZ22
T115	5732+50	7	7	AZ22
T116	5733+90	7	7	AZ23
T117	5735+00	7	7	AZ23
T118	5736+50	7	7	AZ23
T119	5738+00	7	7	AZ23
T120	5739+45	7	7	AZ23

Table 17. Locations of plate bearing tests on **Bituminous Treated Base**, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line, Rt	Outside Lane Edge, Lt	
PB14	5729+50	7	7	AZ22

Asphalt Concrete Surface

The field and laboratory test plan for the Asphalt Concrete (AC) materials is presented in Table 18. Sampling of this material includes bulk samples of the asphalt, aggregate, and uncompacted mix and cores obtained after placement and compaction of the AC surface material. Nuclear density tests should also be performed on the compacted surface.

Bulk Samples

Bulk sampling of the uncompacted mix should be performed at the test site from a haul vehicle. Care should be taken to obtain the designated samples of the materials to be placed in the test sections shown in Figure 5. These samples shall be obtained in accordance with AASHTO T168 and shipped to the laboratory in suitable containers. If sampling from the haul vehicle at the test site is not feasible, then bulk sampling can be performed at the mix plant provided that the material sampled is the same material being placed in the designated test section. Each sample shall consist of 100 lbs of material.

Samples of the asphalt cement should consist of three 5 gallon samples obtained from the mix plant. Collect samples from the mix plant after asphalt has been heated for mixing. Only three samples of each type of asphalt cement used on the project are needed. If the same asphalt cement is used for the Permeable Bituminous Treated Base or the Bituminous Treated Base, then only three samples of this asphalt cement are needed.

In addition to the bulk samples described above for SPS testing purposes, the following bulk samples should be obtained for the SHRP Reference Materials Laboratory:

- 55 gallons of asphalt cement used in the asphalt concrete mix. Collect from mix plant after asphalt has been heated for mixing. Eleven 5-gallon pails will be provided by SHRP for storage and shipping.
- 1,000 lbs of the finished aggregate product (combined coarse and fine aggregate) used in the asphalt concrete mix. This material shall be sampled in accordance with applicable portions of AASHTO Designation T2. For drum plants, the aggregate should be obtained from the charging (inclined) conveyor using the bypass chute, if possible. Otherwise the material should be taken from the belt on the charging conveyor. The aggregates should be sampled from the inclined conveyor at the dryer on batch plants. This material should be collected in two 55-gallon drums supplied by SHRP.
- 200 lbs of the finished asphalt concrete mix material used on the test sections. This material shall be sampled at the plant or from haul trucks in accordance with applicable sections of AASHTO T168. SHRP will provide 5-gallon containers for shipment and storage of this material.

Cores

All cores of the asphalt concrete surface shall have a 4" diameter. The core locations are listed in Table 19. The cores of the AC material designated for resilient modulus, indirect tensile strength, and creep modulus must be shipped to the designated FHWA laboratory after the core examination and bulk specific gravity tests have been performed. The resilient modulus test, indirect tensile strength test, and creep modulus test will be performed under a separate contract with the Federal Highway Administration.

The cores listed in Table 20 shall be obtained for shipment to the SHRP Materials Reference Library. These cores are designated as CS-##.

Care shall be taken to insure that cores are obtained at a 90° angle to the pavement surface and that the edges are straight, intact, smooth and suitable for laboratory testing. Details on tolerances and quality control of coring operations are contained in Section 4 of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling.

Care shall be taken to package all cores for transport and shipping in suitable containers to prevent damage or degradation of the core during transport.

Density Measurements

Nuclear density measurements shall be performed on top of the prepared AC at the locations specified in Table 21. These measurements shall be performed following a similar procedure to that used for subgrade soils.

Table 18. Field sampling and laboratory test plan for Asphalt Concrete surface materials, SPS-2 Arizona.

Test Name	SHRP Test Designation	SHRP Protocol	No. of Tests	Material Source / Test Location
Core Examination/Thickness	AC01	P01	12	C1-C6, C182-C187
Bulk Specific Gravity	AC02	P02	12	C1-C6, C182-C187
Maximum Specific Gravity	AC03	P03	2	BT7-BT8
Asphalt Content (Extraction)	AC04	P04	2	BT7-BT8
Moisture Susceptibility	AC05	P05	2	BT7-BT8
Creep Modulus	AC06	P06	1	C5, C186, C187
Resilient Modulus	AC07	Ship to FHWA Lab	2	C1-C3, C182-C184
Indirect Tensile Strength	AC07	Ship to FHWA Lab	8	C1-C4, C182-C185
In-Place Density		SHRP- LTPP Method	10	T121-T125, T126-T130
Extracted Aggregate				
Bulk Specific Gravity of Coarse Aggregate	AG01	P11	2	BT7, BT8
Bulk Specific Gravity of Fine Aggregate	AG02	P12	2	BT7, BT8
Type and Class of Coarse Aggregate	AG03	P13	2	BT7, BT8
Type and Class of Fine Aggregate	AG03	P13	2	BT7, BT8
Aggregate Gradation	AG04	P14	2	BT7, BT8
NAA Test for Fine Aggregate Particle Shape	AG05	P14A	2	BT7, BT8
Coarse Aggregate Particle Shape	AG06	P14B	2	BT7, BT8
Asphalt Cement				
Abson Recovery	AE01	P21	2	BT7, BT8
Penetration @ 50F, 77F, 90F	AE02	P22	2	BT7, BT8
Specific Gravity (60F)	AE03	P23	2	BT7, BT8
Viscosity @ 77F	AE04	P24	2	BT7, BT8
Viscosity @ 140F, 275F	AE05	P25	2	BT7, BT8
Asphalt Cement (from plant)				
Penetration @ 50F, 77F, 90F	AE02	P22	2	BC3, BC4
Specific Gravity (60F)	AE03	P23	2	BC3, BC4
Viscosity @ 77F	AE04	P24	2	BC3, BC4
Viscosity @ 140F, 275F	AE05	P25	2	BC3, BC4

Table 18. Field sampling and laboratory test plan for Asphalt Concrete surface materials, SPS-2 Arizona (Contd.).

Test Name	SHRP Protocol	Amount	Material Source / Test Location
Cores for SHRP Asphalt Research Program	Ship to SHRP Materials Reference Library	24	CS1 - CS24
Asphalt samples for SHRP Asphalt Research Program		55 gallons 5 gal containers	Obtain from asphalt concrete mix plant
Aggregate samples for SHRP Asphalt Research Program		1,000 lbs 55 gal drums	
Bulk asphalt concrete sample for SHRP Asphalt Research Program		200 lbs 5 gal containers	

Table 19. Asphalt Concrete core locations, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area
		Center Line, Rt	Outside Lane Edge, Lt		
C1	5587+90	4.5	7.5	AZ24 (040260)	1
C2	5587+90	6	6	AZ24	1
C3	5587+90	7.5	4.5	AZ24	1
C4	5587+90	9	3	AZ24	1
C5	5593+70	6	6	AZ24	2
C6	5593+70	9	3	AZ24	2
C182	5741+00	4.5	7.5	AZ24 (040261)	41
C183	5741+00	6	6	AZ24	41
C184	5741+00	7.5	4.5	AZ24	41
C185	5741+00	9	3	AZ24	41
C186	5746+86	6	6	AZ24	42
C187	5746+86	9	3	AZ24	42

Table 20. Locations for cores of the Asphalt Concrete for the SHRP Materials Reference Library, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area
		Center Line, Rt.	Outside lane Edge, Lt		
CS1	5746+88	3	9	AZ24	42
CS2	5746+89.5	2	10	AZ24	42
CS3	5746+89.5	4	8	AZ24	42
CS4	5746+91	3	9	AZ24	42
CS5	5746+92.5	2	10	AZ24	42
CS6	5746+92.5	4	8	AZ24	42
CS7	5746+94	3	9	AZ24	42
CS8	5746+95.5	2	10	AZ24	42
CS9	5746+95.5	4	8	AZ24	42
CS10	5746+97	3	9	AZ24	42
CS11	5746+98.5	2	10	AZ24	42
CS12	5746+98.5	4	8	AZ24	42
CS13	5746+88	6	6	AZ24	42
CS14	5746+89.5	5	7	AZ24	42
CS15	5746+89.5	7	5	AZ24	42
CS16	5746+91	6	6	AZ24	42
CS17	5746+92.5	5	7	AZ24	42
CS18	5746+92.5	7	5	AZ24	42
CS19	5746+94	6	6	AZ24	42
CS20	5746+95.5	5	7	AZ24	42
CS21	5746+95.5	7	5	AZ24	42
CS22	5746+97	6	6	AZ24	42
CS23	5746+98.5	5	7	AZ24	42
CS24	5746+98.5	7	5	AZ24	42

Table 22. Locations for in-place density measurements on compacted Asphalt Concrete, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line, Rt	Outside Lane Edge, Lt	
T121	5587+75	6	6	AZ24 (040261)
T122	5589+20	6	6	AZ24
T123	5590+70	6	6	AZ24
T124	5592+20	6	6	AZ24
T125	5593+65	6	6	AZ24
T126	5740+91	6	6	AZ24 (040260)
T127	5742+36	6	6	AZ24
T128	5743+86	6	6	AZ24
T129	5745+36	6	6	AZ24
T130	5746+81	6	6	AZ24

Lean Concrete Base

Sampling of the Lean Concrete Base (LCB) materials shall include beams and cylinders molded from bulk samples of the as-delivered material, and cores obtained from the material as placed. In general, the applicable portion of the specifications for sampling, molding, curing and transportation of PCC materials shall apply to LCB materials.

As-Delivered

Sampling of the concrete used in the LCB shall be performed in the field, during or just before placement. The test sections from which the designated bulk samples should be obtained are shown in Table 22. These samples shall be obtained in accordance with **AASHTO T141 "Sampling Fresh Concrete"**, molded into the specimens specified in Table 23, cured, packaged and shipped to the laboratory in time for the specified tests to be performed. Tests on the molded specimens are specified at 7 day, 8 day, and 1 year. As shown in Table 23, six - 6" by 12" cylindrical specimens shall be molded from each bulk sample.

As-Placed

Sampling of the as-placed LCB materials shall consist of 4 inch diameter cores. The cores shall be obtained from 1 to 4 days **prior** to the specified age for conduct of the laboratory tests. In Table 25, tests on the cores are specified at 14 days, 28 days, and 1 year after placement. The objective of these tests are to characterize the properties of the material after being subjected to in-place curing conditions. These cores shall be obtained during the following time periods:

Specified Test Age	Date After Placement to Obtain Cores
14 days	10 - 13 days
28 days	21 - 24 days
1 year	350 - 360 days

After placement of the PCC surface layer over the LCB, coring of the LCB must be performed through the PCC surface layer. Prior to placement of the PCC layer, the cores of the LCB should be obtained directly from the surface of the LCB and the core holes repaired. The locations of the LCB cores specified in Table 25 are shown in Table 26. After cores for the strength tests are taken they must be soaked in a lime water bath for a period of 40 hours immediately prior to testing. Coring operations shall be performed in accordance with **AASHTO T24 "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete"** using equipment specified in the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling. Plugs shall not be inserted in cores intended for laboratory testing.

Care shall be taken to insure that cores are obtained at a 90° angle to the surface and that the edges are straight, intact, smooth and suitable for laboratory testing. Details on tolerances and quality control of coring operations are contained in Section 4 of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling.

Portland Cement Concrete

Sampling of the Portland Cement Concrete (PCC) materials shall include beams and cylinders molded from bulk samples of the as-delivered material, and cores obtained from the material as placed.

As-Delivered

Sampling of the concrete used in the PCC mix shall be performed in the field, during or just before placement. A summary of the sampling and testing plan for the as-delivered PCC materials are shown in Table 22. The test sections from which the designated bulk samples should be obtained are also shown in this table. These samples shall be obtained in accordance with **AASHTO T141 "Sampling Fresh Concrete"**, molded into the specimens specified in Table 24, cured, packaged and shipped to the laboratory. All specimens shall be made and cured in the field in accordance with **AASHTO T23 "Making and Curing Concrete Specimens in the Field"** and **AASHTO T126 "Making and Curing Concrete Specimens in the Laboratory"**. As shown in Table 24, six - 6" by 12" cylindrical specimens and three - 6"x6" by 20 inch long beam specimens shall be molded from each bulk sample. Molded concrete samples shall be transported in accordance with **Section 10, "Transportation of Specimens to Laboratory"** of **ASTM C31**.

Field tests shall be performed on the bulk samples of fresh concrete to determine mix temperature, slump, and air content (volumetric). Samples shall be obtained in accordance with **ASTM C172** and tests performed in accordance with **ASTM C1064** (temperature), **ASTM C231** (air content), and **ASTM C143** (slump).

As-Placed

A summary of the sampling and testing plan for the as-placed (PCC) materials are shown in Table 25. Sampling of the as-placed PCC materials shall consist of 4 inch diameter cores. The cores shall be obtained from 1 to 4 days **prior** to the specified age for conduct of the laboratory tests. This is to allow for a 40 hour lime water bath soak period immediately prior to testing the strength specimen. In Table 25, tests on the cores are specified at 14 days, 28 days, and 1 year after placement. The objective of these tests are to characterize the properties of the concrete after being subjected to in-place curing conditions. These cores shall be obtained during the following time periods:

Specified Test Age	Date After Placement to Obtain Cores
14 days	10 - 13 days
28 days	24 - 27 days
1 year	360 - 364 days

The locations of the PCC cores specified in Table 25 are shown in Table 26. Coring operations shall be performed in accordance with **AASHTO T24 "Obtaining and Testing**

Drilled Cores and Sawed Beams of Concrete" using equipment specified in the SHRP-LTPP Guide for Field Materials Sampling, testing and Handling. Plugs shall not be inserted in cores intended for laboratory testing. All cores shall be dried prior to packaging.

Care shall be taken to insure that cores are obtained at a 90° angle to the pavement surface and that the edges are straight, intact, smooth and suitable for laboratory testing. Details on tolerances and quality control of coring operations are contained in Section 4 of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling.

Table 22. Field and laboratory test plan for as-delivered **Lean Concrete Base and PCC materials**, SPS-2 Arizona.

Test Name	LTPP Test Designation	LTPP Protocol	No. of Tests	Material Source / Test Location
Lean Concrete Base - As Delivered				
Compressive Strength	PC01	P61		
7 Day			6	BL1-BL3 (Note 1)
28 Day			6	
1 Year			6	
Portland Cement Concrete - As Delivered (Note 2)				
Compressive Strength	PC01	P61		550 psi PCC mix 900 psi PCC mix
14 Day			9	FC04,FC05,FC06, FC07,FC08,FC09 FC01,FC02,FC03
28 Day			9	
1 Year			9	
Splitting Tensile Strength	PC02	P62		550 psi PCC mix 900 psi PCC mix
14 Day			9	FC04,FC05,FC06, FC07,FC08,FC09 FC01,FC02,FC03
28 Day			9	
1 Year			9	
Flexural Strength	PC09	P69		550 psi PCC mix 900 psi PCC mix
14 Day			9	FC04,FC05,FC06, FC07,FC08,FC09 FC01,FC02,FC03
28 Day			9	
1 Year			9	
Air Content	ASTM C231	LTPP Method	9	FC01 - FC09
Slump	ASTM C143	LTPP Method	9	FC01 - FC09
Temperature	ASTM C1064	LTPP Method	9	FC01 - FC09

Notes:

1. A total of 6 cylinder specimens are molded from each bulk sample, two specimens for each cure age.
2. A total of 6 cylinder specimens and 3 beam specimens are molded from each PCC bulk sample.

Table 23. Bulk samples and molded specimens from Lean Concrete Base, SPS-2 Arizona.

Sample Number	Test Age After Placement	Specimen Number 6x12" Cylinder Compression Test	Test Section
BL1	7 days	LX01, LX02	18
	28 days	LY03, LY04	
	1 year	LZ05, LZ06	
BL2	7 days	LX07, LX08	19
	28 days	LY09, LY10	
	1 year	LZ11, LZ12	
BL3	7 days	LX13, LX14	17
	28 days	LY15, LY16	
	1 year	LZ17, LZ18	

Table 24. Bulk samples and molded specimens from PCC mix, SPS-2 Arizona.

Sample Number	Test Age After Placement	Specimen Number			Test Section
		6x12" Cylinder Compression	6x12" Cylinder Indirect Tensile	6x6x12" Beam Flexural Strength	
FC01	14 days	GX01	GX04	FX01	14
	28 days	GY02	GY05	FY02	
	1 year	GZ03	GZ06	FZ03	
FC02	14 days	GX07	GX10	FX04	20
	28 days	GY08	GY11	FY05	
	1 year	GZ09	GZ12	FZ06	
FC03	14 days	GX13	GX16	FX07	16
	28 days	GY14	GY17	FY08	
	1 year	GZ15	GZ18	FZ09	
FC04	14 days	GX19	GX22	FX10	15
	28 days	GY20	GY23	FY11	
	1 year	GZ21	GZ24	FZ12	
FC05	14 days	GX25	GX28	FX13	19
	28 days	GY26	GY29	FY14	
	1 year	GZ27	GZ30	FZ15	
FC06	14 days	GX31	GX34	FX16	13
	28 days	GY32	GY35	FY17	
	1 year	GZ33	GZ36	FZ18	
FC07	14 days	GX37	GX40	FX19	B31
	28 days	GY38	GY41	FY20	
	1 year	GZ39	GZ42	FZ21	
FC08	14 days	GX43	GX46	FX22	B32
	28 days	GY44	GY47	FY23	
	1 year	GZ45	GZ48	FZ24	
FC09	14 days	GX49	GX52	FX25	AZ23
	28 days	GY50	GY53	FY26	
	1 year	GZ51	GZ54	FZ27	

Table 25. Field and laboratory test plan for as-placed LCB and PCC materials, SPS-2 Arizona.

Test Name (Age)	LTPP Test Designation	LTPP Protocol	No. of Tests	Material Source/ Test Location
Lean Concrete Base - As Placed				
Compressive Strength	PC01	P61		
14 Day			6	C23, C34, C78, C81, C92, C95
28 Day			6	C24, C35, C79, C90, C93, C104
1 Year			6	C25, C36, C80, C91, C94, C105
Portland Cement Concrete - As Placed				
Compressive Strength	PC01	P61		
14 Day			19	C7, C15, C26, C37, C51, C53, C61, C75, C82, C96, C114, C122, C123, C131, C139, C148, C157, C165, C173
28 Day			19	C8, C16, C27, C38, C52, C54, C62, C70, C83, C97, C106, C115, C124, C132, C140, C149, C158, C166, C174
1 Year			19	C9, C17, C28, C39, C47, C55, C64, C74, C84, C98, C107, C116, C125, C133, C142, C150, C159, C167, C176
Splitting Tensile Strength	PC02	P62		
14 Day			19	C10, C18, C29, C40, C48, C56, C65, C73, C85, C99, C109, C117, C126, C134, C143, C151, C160, C168, C177
28 Day			19	C11, C19, C30, C41, C49, C57, C66, C72, C86, C100, C110, C118, C127, C135, C144, C152, C161, C169, C178
1 Year			19	C13, C21, C32, C43, C45, C59, C67, C76, C88, C102, C112, C120, C129, C137, C146, C154, C163, C171, C180
PCC Unit Weight	PC05	P65	57	All compressive strength cores
Static Modulus of Elasticity	PC04	P64		
28 Day			19	C12, C31, C42, C50, C58, C63, C69, C71, C87, C101, C108, C128, C136, C141, C145, C162, C170, C175, C179
1 Year			18	C14, C33, C44, C46, C60, C68, C77, C89, C103, C113, C121, C130, C138, C147, C155, C164, C172, C181
Air Content @ 28 Days	PC08	P68	3	C22, C111, C156
PCC Thermal Coef.		Ship to FHWA	3	C20, C119, C153

Table 26. PCC and bound base core locations, SPS-2 Arizona.

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area	Days After Placement
		Center Line, Rt	Outside Lane Edge, Lt			
C7	5594+84	6.0	6.0	14	3	10-13
C8	5594+84	7.5	4.5	14	3	21-24
C9	5594+84	9.0	3.0	14	3	350-360
C10	5600+81	3.0	9.0	14	4	10-13
C11	5600+81	4.5	7.5	14	4	21-24
C12	5600+81	6.0	6.0	14	4	21-24
C13	5600+81	7.5	4.5	14	4	350-360
C14	5600+81	9.0	3.0	14	4	350-360
C15	5601+89	4.5	7.5	22	5	10-13
C16	5601+89	6.0	6.0	22	5	350-360
C17	5601+89	7.5	4.5	22	5	350-360
C18	5601+89	9.0	3.0	22	5	10-13
C19 ¹	5607+86	4.5	7.5	22	6	21-24
C20 ¹	5607+86	6.0	6.0	22	6	21-24
C21 ¹	5607+86	7.5	4.5	22	6	21-24
C22 ¹	5607+86	9.0	3.0	22	6	21-24
C23	5609+22	4.5	7.5	18	7	10-13 ²
C24	5609+22	6.0	6.0	18	7	21-24 ²
C25	5609+22	7.5	4.5	18	7	350-360 ²
C26	5609+25	4.5	7.5	18	7	10-13
C27	5609+25	6.0	6.0	18	7	21-24
C28	5609+25	7.5	4.5	18	7	350-360
C29	5609+25	9.0	3.0	18	7	10-13
C30	5615+38	4.5	7.5	18	8	21-24
C31	5615+38	6.0	6.0	18	8	21-24
C32	5615+38	7.5	4.5	18	8	350-360
C33	5615+38	9.0	3.0	18	8	350-360
C34	5619+72	6.0	8.0	20	9	10-13 ²
C35	5619+72	7.5	6.5	20	9	21-24 ²
C36	5619+72	9.0	5.0	20	9	350-360 ²
C37	5619+75	6.0	8.0	20	9	10-13

1 - Core includes PBTB and PCC samples.

2 - LCB Core. Time from LCB placement.

Table 26. PCC and bound base core locations, SPS-2 Arizona (Contd.).

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area	Days After Placement
		Center Line, Rt	Outside Lane Edge, Lt			
C38	5619+75	7.5	6.5	20	9	21-24
C39	5619+75	9.0	5.0	20	9	350-360
C40	5625+88	3.0	11.0	20	10	10-13
C41	5625+88	4.5	9.5	20	10	21-24
C42	5625+88	6.0	8.0	20	10	21-24
C43	5625+88	7.5	6.5	20	10	350-360
C44	5625+88	9.0	5.0	20	10	350-360
C45	5626+92	4.5	9.5	24	11	350-360
C46	5626+92	6.0	8.0	24	11	350-360
C47	5626+92	7.5	6.5	24	11	350-360
C48	5626+92	9.0	5.0	24	11	10-13
C49 ¹	5633+06	4.5	9.5	24	12	21-24
C50 ¹	5633+06	6.0	8.0	24	12	21-24
C51 ¹	5633+06	7.5	6.5	24	12	10-13
C52 ¹	5633+06	9.0	5.0	24	12	21-24
C53	5634+27	4.5	9.5	16	13	10-13
C54	5634+27	6.0	8.0	16	13	21-24
C55	5634+27	7.5	6.5	16	13	350-360
C56	5634+27	9.0	5.0	16	13	10-13
C57	5640+13	4.5	9.5	16	14	21-24
C58	5640+13	6.0	8.0	16	14	21-24
C59	5640+13	7.5	6.5	16	14	350-360
C60	5640+13	9.0	5.0	16	14	350-360
C61	5643+87	4.5	7.5	15	15	10-13
C62	5643+87	6.0	6.0	15	15	21-24
C63	5643+87	7.5	4.5	15	15	21-24
C64	5643+87	9.0	3.0	15	15	350-360
C65	5650+03	4.5	7.5	15	16	10-13
C66	5650+03	6.0	6.0	15	16	21-24
C67	5650+03	7.5	4.5	15	16	350-360
C68	5650+03	9.0	3.0	15	16	350-360

1 - Core includes PBTB and PCC samples.

Table 26. PCC and bound base core locations, SPS-2 Arizona (Contd.).

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area	Days After Placement
		Center Line, Rt	Outside Lane Edge, Lt			
C69 ¹	5651+09	4.5	7.5	23	17	21-24
C70 ¹	5651+09	6.0	6.0	23	17	21-24
C71 ¹	5651+09	7.5	4.5	23	17	21-24
C72 ¹	5651+09	9.0	3.0	23	17	21-24
C73	5657+08	3.0	9.0	23	18	10-13
C74	5657+08	4.5	7.5	23	18	350-360
C75	5657+08	6.0	6.0	23	18	10-13
C76	5657+08	7.5	4.5	23	18	350-360
C77	5657+08	9.0	3.0	23	18	350-360
C78	5658+56	4.5	7.5	19	19	10-13 ²
C79	5658+56	6.0	6.0	19	19	21-24 ²
C80	5658+56	7.5	4.5	19	19	350-360 ²
C81	5658+56	9.0	3.0	19	19	10-13 ²
C82	5658+59	4.5	7.5	19	19	10-13
C83	5658+59	6.0	6.0	19	19	21-24
C84	5658+59	7.5	4.5	19	19	350-360
C85	5658+59	9.0	3.0	19	19	10-13
C86	5664+71	4.5	7.5	19	20	21-24
C87	5664+71	6.0	6.0	19	20	21-24
C88	5664+71	7.5	4.5	19	20	350-360
C89	5664+71	9.0	3.0	19	20	350-360
C90	5664+74	4.5	7.5	19	20	21-24 ²
C91	5664+74	6.0	6.0	19	20	350-360 ²
C92	5666+51	4.5	9.5	17	21	10-13 ²
C93	5666+51	6.0	8.0	17	21	21-24 ²
C94	5666+51	7.5	6.5	17	21	350-360 ²
C95	5666+51	9.0	5.0	17	21	10-13 ²
C96	5666+54	4.5	9.5	17	21	10-13
C97	5666+54	6.0	8.0	17	21	21-24

1 - Core includes PBTB and PCC samples.

2 - LCB Core. Time from LCB placement.

Table 26. PCC and bound base core locations, SPS-2 Arizona (Contd.).

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area	Days After Placement
		Center Line, Rt	Outside Lane Edge, Lt			
C98	5666+54	7.5	6.5	17	21	350-360
C99	5666+54	9.0	5.0	17	21	10-13
C100	5672+66	4.5	9.5	17	22	21-24
C101	5672+66	6.0	8.0	17	22	21-24
C102	5672+66	7.5	6.5	17	22	350-360
C103	5672+66	9.0	5.0	17	22	350-360
C104	5672+69	4.5	9.5	17	22	21-24 ²
C105	5672+69	6.0	8.0	17	22	350-360 ²
C106	5674+19	4.5	9.5	21	23	21-24
C107	5674+19	6.0	8.0	21	23	350-360
C108	5674+19	7.5	6.5	21	23	21-24
C109	5674+19	9.0	5.0	21	23	10-13
C110 ¹	5680+18	4.5	9.5	21	24	21-24
C111 ¹	5680+18	6.0	8.0	21	24	21-24
C112 ¹	5680+18	7.5	6.5	21	24	350-360
C113 ¹	5680+18	9.0	5.0	21	24	350-360
C114	5681+36	4.5	9.5	13	25	10-13
C115	5681+36	6.0	8.0	13	25	21-24
C116	5681+36	7.5	6.5	13	25	350-360
C117	5681+36	9.0	5.0	13	25	10-13
C118	5687+54	3.0	11.0	13	26	21-24
C119	5687+54	4.5	9.5	13	26	21-24
C120	5687+54	6.0	8.0	13	26	350-360
C121	5687+54	7.5	6.5	13	26	350-360
C122	5687+54	9.0	5.0	13	26	10-13
C123*	5688+41	4.5	9.5	B31	27	10-13
C124*	5688+41	6.0	8.0	B31	27	21-24

1 - Core includes PBTB and PCC samples.

2 - LCB Core. Time from LCB placement.

* - Approximate location, actual location will depend on constructed joint spacing sequence.

Table 26. PCC and bound base core locations, SPS-2 Arizona (Contd.).

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area	Days After Placement
		Center Line, Rt	Outside Lane Edge, Lt			
C125*	5688+41	7.5	6.5	B31	27	350-360
C126*	5688+41	9.0	5.0	B31	27	10-13
C127*	5694+59	4.5	9.5	B31	28	21-24
C128*	5694+59	6.0	8.0	B31	28	21-24
C129*	5694+59	7.5	6.5	B31	28	350-360
C130*	5694+59	9.0	5.0	B31	28	350-360
C131*¹	5698+41	4.5	9.5	B35	29	10-13
C132*¹	5698+41	6.0	8.0	B35	29	21-24
C133*¹	5698+41	7.5	6.5	B35	29	350-360
C134*¹	5698+41	9.0	5.0	B35	29	10-13
C135*	5704+59	4.5	9.5	B35	30	21-24
C136*	5704+59	6.0	8.0	B35	30	21-24
C137*	5704+59	7.5	6.5	B35	30	350-360
C138*	5704+59	9.0	5.0	B35	30	350-360
C139*¹	5706+37	4.5	7.5	B36	31	10-13
C140*¹	5706+37	6.0	6.0	B36	31	21-24
C141*¹	5706+37	7.5	4.5	B36	31	21-24
C142*¹	5706+37	9.0	3.0	B36	31	350-360
C143*	5711+61	3.0	9.0	B36	32	10-13
C144*	5711+61	4.5	7.5	B36	32	21-24
C145*	5711+61	6.0	6.0	B36	32	21-24
C146*	5711+61	7.5	4.5	B36	32	350-360
C147*	5711+61	9.0	3.0	B36	32	350-360
C148*	5712+59	4.5	7.5	B32	33	10-13
C149*	5712+59	6.0	6.0	B32	33	21-24
C150*	5712+59	7.5	4.5	B32	33	350-360
C151*	5712+59	9.0	3.0	B32	33	10-13
C152*	5718+58	3.0	9.0	B32	34	21-24

1 - Core includes PBTB and PCC samples.

2 - LCB Core. Time from LCB placement.

* - Approximate location, actual location will depend on constructed joint spacing sequence.

Table 26. PCC and bound base core locations, SPS-2 Arizona (Contd.).

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area	Days After Placement
		Center Line, Rt	Outside Lane Edge, Lt			
C153*	5718+58	4.5	7.5	B32	34	21-24
C154*	5718+58	6.0	6.0	B32	34	350-360
C155*	5718+58	7.5	4.5	B32	34	350-360
C156*	5718+58	9.0	3.0	B32	34	21-24
C157*	5719+88	4.5	9.5	AZ21	35	10-13
C158*	5719+88	6.0	8.0	AZ21	35	21-24
C159*	5719+88	7.5	6.5	AZ21	35	350-360
C160*	5719+88	9.0	5.0	AZ21	35	10-13
C161* ¹	5725+41	4.5	9.5	AZ21	36	21-24
C162* ¹	5725+41	6.0	8.0	AZ21	36	21-24
C163* ¹	5725+41	7.5	6.5	AZ21	36	350-360
C164* ¹	5725+41	9.0	5.0	AZ21	36	350-360
C165*	5726+88	4.5	9.5	AZ22	37	10-13
C166*	5726+88	6.0	8.0	AZ22	37	21-24
C167*	5726+88	7.5	6.5	AZ22	37	350-360
C168*	5726+88	9.0	5.0	AZ22	37	10-13
C169* ¹	5732+41	4.5	9.5	AZ22	38	21-24
C170* ¹	5732+41	6.0	8.0	AZ22	38	21-24
C171* ¹	5732+41	7.5	6.5	AZ22	38	350-360
C172* ¹	5732+41	9.0	5.0	AZ22	38	350-360
C173* ¹	5733+88	4.5	9.5	AZ23	39	10-13
C174* ¹	5733+88	6.0	8.0	AZ23	39	21-24
C175* ¹	5733+88	7.5	6.5	AZ23	39	21-24
C176* ¹	5733+88	9.0	5.0	AZ23	39	350-360
C177*	5739+41	3.0	11.0	AZ23	40	10-13
C178*	5739+41	4.5	9.5	AZ23	40	21-24
C179*	5739+41	6.0	8.0	AZ23	40	21-24
C180*	5739+41	7.5	6.5	AZ23	40	350-360
C181*	5739+41	9.0	5.0	AZ23	40	350-360

1 - Core includes BTB and PCC samples.

* - Approximate location, actual location will depend on constructed joint spacing sequence.

Elevation Measurements

Elevation measurements shall be made on the surface of each pavement layer (prepared subgrade or embankment, Dense Graded Aggregate Base, Permeable Bituminous Treated Base, Bituminous Treated Base, Lean Concrete Base, Asphalt Concrete Surface, and PCC surface) at the locations specified in Table 29. Measurements must be made to an accuracy of 0.01 feet. Care must be taken to re-establish the same points on the surface of each succeeding material layer to insure accurate determination of the thickness of each layer.

Table 27. Elevation survey locations, SPS-2 Arizona.

Sample Location Designation	Station	Rt. Offset, Center Line, feet					Lt. Offset, Lane Edge, feet					Test Section
		1	2	3	4	5	1	2	3	4	5	
E1	5595+25	12	9	6	3	0	0	3	6	9	12	14
E2	5595+75	12	9	6	3	0	0	3	6	9	12	14
E3	5596+25	12	9	6	3	0	0	3	6	9	12	14
E4	5596+75	12	9	6	3	0	0	3	6	9	12	14
E5	5597+25	12	9	6	3	0	0	3	6	9	12	14
E6	5597+75	12	9	6	3	0	0	3	6	9	12	14
E7	5598+25	12	9	6	3	0	0	3	6	9	12	14
E8	5598+75	12	9	6	3	0	0	3	6	9	12	14
E9	5599+25	12	9	6	3	0	0	3	6	9	12	14
E10	5599+75	12	9	6	3	0	0	3	6	9	12	14
E11	5600+25	12	9	6	3	0	0	3	6	9	12	14
E12	5602+30	12	9	6	3	0	0	3	6	9	12	22
E13	5602+80	12	9	6	3	0	0	3	6	9	12	22
E14	5603+30	12	9	6	3	0	0	3	6	9	12	22
E15	5603+80	12	9	6	3	0	0	3	6	9	12	22
E16	5604+30	12	9	6	3	0	0	3	6	9	12	22
E17	5604+80	12	9	6	3	0	0	3	6	9	12	22
E18	5605+30	12	9	6	3	0	0	3	6	9	12	22
E19	5605+80	12	9	6	3	0	0	3	6	9	12	22
E20	5606+30	12	9	6	3	0	0	3	6	9	12	22
E21	5606+80	12	9	6	3	0	0	3	6	9	12	22
E22	5607+30	12	9	6	3	0	0	3	6	9	12	22
E23	5609+80	12	9	6	3	0	0	3	6	9	12	18
E24	5610+30	12	9	6	3	0	0	3	6	9	12	18
E25	5610+80	12	9	6	3	0	0	3	6	9	12	18
E26	5611+30	12	9	6	3	0	0	3	6	9	12	18
E27	5611+80	12	9	6	3	0	0	3	6	9	12	18
E28	5612+30	12	9	6	3	0	0	3	6	9	12	18
E29	5612+80	12	9	6	3	0	0	3	6	9	12	18
E30	5613+30	12	9	6	3	0	0	3	6	9	12	18
E31	5613+80	12	9	6	3	0	0	3	6	9	12	18
E32	5614+30	12	9	6	3	0	0	3	6	9	12	18
E33	5614+80	12	9	6	3	0	0	3	6	9	12	18

Table 27. Elevation survey locations, SPS-2 Arizona.

Sample Location Designation	Station	Rt. Offset, Center Line, feet					Lt. Offset, Lane Edge, feet					Test Section
		1	2	3	4	5	1	2	3	4	5	
E1	5588+20	12	9	6	3	0	0	3	6	9	12	AZ24 (040261)
E2	5588+70	12	9	6	3	0	0	3	6	9	12	AZ24
E3	5589+20	12	9	6	3	0	0	3	6	9	12	AZ24
E4	5589+70	12	9	6	3	0	0	3	6	9	12	AZ24
E5	5590+20	12	9	6	3	0	0	3	6	9	12	AZ24
E6	5590+70	12	9	6	3	0	0	3	6	9	12	AZ24
E7	5591+20	12	9	6	3	0	0	3	6	9	12	AZ24
E8	5591+70	12	9	6	3	0	0	3	6	9	12	AZ24
E9	5592+20	12	9	6	3	0	0	3	6	9	12	AZ24
E10	5592+70	12	9	6	3	0	0	3	6	9	12	AZ24
E11	5593+20	12	9	6	3	0	0	3	6	9	12	AZ24
E12	5595+25	12	9	6	3	0	0	3	6	9	12	14
E13	5595+75	12	9	6	3	0	0	3	6	9	12	14
E14	5596+25	12	9	6	3	0	0	3	6	9	12	14
E15	5596+75	12	9	6	3	0	0	3	6	9	12	14
E16	5597+25	12	9	6	3	0	0	3	6	9	12	14
E17	5597+75	12	9	6	3	0	0	3	6	9	12	14
E18	5598+25	12	9	6	3	0	0	3	6	9	12	14
E19	5598+75	12	9	6	3	0	0	3	6	9	12	14
E20	5599+25	12	9	6	3	0	0	3	6	9	12	14
E21	5599+75	12	9	6	3	0	0	3	6	9	12	14
E22	5600+25	12	9	6	3	0	0	3	6	9	12	14
E23	5602+30	12	9	6	3	0	0	3	6	9	12	22
E24	5602+80	12	9	6	3	0	0	3	6	9	12	22
E25	5603+30	12	9	6	3	0	0	3	6	9	12	22
E26	5603+80	12	9	6	3	0	0	3	6	9	12	22
E27	5604+30	12	9	6	3	0	0	3	6	9	12	22
E28	5604+80	12	9	6	3	0	0	3	6	9	12	22
E29	5605+30	12	9	6	3	0	0	3	6	9	12	22
E30	5605+80	12	9	6	3	0	0	3	6	9	12	22
E31	5606+30	12	9	6	3	0	0	3	6	9	12	22
E32	5606+80	12	9	6	3	0	0	3	6	9	12	22
E33	5607+30	12	9	6	3	0	0	3	6	9	12	22

Table 27. Elevation survey locations, SPS-2 Arizona (Contd.).

Sample Location Designation	Station	Rt. Offset, Center Line, Feet					Lt. Offset, Lane Edge, Feet					Test Section
		1	2	3	4	5	1	2	3	4	5	
E34	5609+80	12	9	6	3	0	0	3	6	9	12	18
E35	5610+30	12	9	6	3	0	0	3	6	9	12	18
E36	5610+80	12	9	6	3	0	0	3	6	9	12	18
E37	5611+30	12	9	6	3	0	0	3	6	9	12	18
E38	5611+80	12	9	6	3	0	0	3	6	9	12	18
E39	5612+30	12	9	6	3	0	0	3	6	9	12	18
E40	5612+80	12	9	6	3	0	0	3	6	9	12	18
E41	5613+30	12	9	6	3	0	0	3	6	9	12	18
E42	5613+80	12	9	6	3	0	0	3	6	9	12	18
E43	5614+30	12	9	6	3	0	0	3	6	9	12	18
E44	5614+80	12	9	6	3	0	0	3	6	9	12	18
E45	5620+30	14	9	6	3	0	0	5	8	11	14	20
E46	5620+80	14	9	6	3	0	0	5	8	11	14	20
E47	5621+30	14	9	6	3	0	0	5	8	11	14	20
E48	5621+80	14	9	6	3	0	0	5	8	11	14	20
E49	5622+30	14	9	6	3	0	0	5	8	11	14	20
E50	5622+80	14	9	6	3	0	0	5	8	11	14	20
E51	5623+30	14	9	6	3	0	0	5	8	11	14	20
E52	5623+80	14	9	6	3	0	0	5	8	11	14	20
E53	5624+30	14	9	6	3	0	0	5	8	11	14	20
E54	5624+80	14	9	6	3	0	0	5	8	11	14	20
E55	5625+30	14	9	6	3	0	0	5	8	11	14	20
E56	5627+50	14	9	6	3	0	0	5	8	11	14	24
E57	5628+00	14	9	6	3	0	0	5	8	11	14	24
E58	5628+50	14	9	6	3	0	0	5	8	11	14	24
E59	5629+00	14	9	6	3	0	0	5	8	11	14	24
E60	5629+50	14	9	6	3	0	0	5	8	11	14	24
E61	5630+00	14	9	6	3	0	0	5	8	11	14	24
E62	5630+50	14	9	6	3	0	0	5	8	11	14	24
E63	5631+00	14	9	6	3	0	0	5	8	11	14	24
E64	5631+50	14	9	6	3	0	0	5	8	11	14	24
E65	5632+00	14	9	6	3	0	0	5	8	11	14	24
E66	5632+50	14	9	6	3	0	0	5	8	11	14	24

Table 27. Elevation survey locations, SPS-2 Arizona (Contd.).

Sample Location Designation	Station	Rt. Offset, Center Line, Feet					Lt. Offset, Lane Edge, Feet					Test Section
		1	2	3	4	5	1	2	3	4	5	
E67	5634+70	14	9	6	3	0	0	5	8	11	14	16
E68	5635+20	14	9	6	3	0	0	5	8	11	14	16
E69	5635+70	14	9	6	3	0	0	5	8	11	14	16
E70	5636+20	14	9	6	3	0	0	5	8	11	14	16
E71	5636+70	14	9	6	3	0	0	5	8	11	14	16
E72	5637+20	14	9	6	3	0	0	5	8	11	14	16
E73	5637+70	14	9	6	3	0	0	5	8	11	14	16
E74	5638+20	14	9	6	3	0	0	5	8	11	14	16
E75	5638+70	14	9	6	3	0	0	5	8	11	14	16
E76	5639+20	14	9	6	3	0	0	5	8	11	14	16
E77	5639+70	14	9	6	3	0	0	5	8	11	14	16
E78	5644+45	12	9	6	3	0	0	3	6	9	12	15
E79	5644+95	12	9	6	3	0	0	3	6	9	12	15
E80	5645+45	12	9	6	3	0	0	3	6	9	12	15
E81	5645+95	12	9	6	3	0	0	3	6	9	12	15
E82	5646+45	12	9	6	3	0	0	3	6	9	12	15
E83	5646+95	12	9	6	3	0	0	3	6	9	12	15
E84	5647+45	12	9	6	3	0	0	3	6	9	12	15
E85	5647+95	12	9	6	3	0	0	3	6	9	12	15
E86	5648+45	12	9	6	3	0	0	3	6	9	12	15
E87	5648+95	12	9	6	3	0	0	3	6	9	12	15
E88	5649+45	12	9	6	3	0	0	3	6	9	12	15
E89	5651+50	12	9	6	3	0	0	3	6	9	12	23
E90	5652+00	12	9	6	3	0	0	3	6	9	12	23
E91	5652+50	12	9	6	3	0	0	3	6	9	12	23
E92	5653+00	12	9	6	3	0	0	3	6	9	12	23
E93	5653+50	12	9	6	3	0	0	3	6	9	12	23
E94	5654+00	12	9	6	3	0	0	3	6	9	12	23
E95	5654+50	12	9	6	3	0	0	3	6	9	12	23
E96	5655+00	12	9	6	3	0	0	3	6	9	12	23
E97	5655+50	12	9	6	3	0	0	3	6	9	12	23
E98	5656+00	12	9	6	3	0	0	3	6	9	12	23
E99	5656+50	12	9	6	3	0	0	3	6	9	12	23

Table 27. Elevation survey locations, SPS-2 Arizona (Contd.).

Sample Location Designation	Station	Rt. Offset, Center Line, Feet					Lt. Offset, Lane Edge, Feet					Test Section
		1	2	3	4	5	1	2	3	4	5	
E100	5659+15	12	9	6	3	0	0	3	6	9	12	19
E101	5659+65	12	9	6	3	0	0	3	6	9	12	19
E102	5660+15	12	9	6	3	0	0	3	6	9	12	19
E103	5660+65	12	9	6	3	0	0	3	6	9	12	19
E104	5661+15	12	9	6	3	0	0	3	6	9	12	19
E105	5661+65	12	9	6	3	0	0	3	6	9	12	19
E106	5662+15	12	9	6	3	0	0	3	6	9	12	19
E107	5662+65	12	9	6	3	0	0	3	6	9	12	19
E108	5663+15	12	9	6	3	0	0	3	6	9	12	19
E109	5663+65	12	9	6	3	0	0	3	6	9	12	19
E110	5664+15	12	9	6	3	0	0	3	6	9	12	19
E111	5667+10	14	9	6	3	0	0	5	8	11	14	17
E112	5667+60	14	9	6	3	0	0	5	8	11	14	17
E113	5668+10	14	9	6	3	0	0	5	8	11	14	17
E114	5668+60	14	9	6	3	0	0	5	8	11	14	17
E115	5669+10	14	9	6	3	0	0	5	8	11	14	17
E116	5669+60	14	9	6	3	0	0	5	8	11	14	17
E117	5670+10	14	9	6	3	0	0	5	8	11	14	17
E118	5670+60	14	9	6	3	0	0	5	8	11	14	17
E119	5671+10	14	9	6	3	0	0	5	8	11	14	17
E120	5671+60	14	9	6	3	0	0	5	8	11	14	17
E121	5672+10	14	9	6	3	0	0	5	8	11	14	17
E122	5674+60	14	9	6	3	0	0	5	8	11	14	21
E123	5675+10	14	9	6	3	0	0	5	8	11	14	21
E124	5675+60	14	9	6	3	0	0	5	8	11	14	21
E125	5676+10	14	9	6	3	0	0	5	8	11	14	21
E126	5676+60	14	9	6	3	0	0	5	8	11	14	21
E127	5677+10	14	9	6	3	0	0	5	8	11	14	21
E128	5677+60	14	9	6	3	0	0	5	8	11	14	21
E129	5678+10	14	9	6	3	0	0	5	8	11	14	21
E130	5678+60	14	9	6	3	0	0	5	8	11	14	21
E131	5679+10	14	9	6	3	0	0	5	8	11	14	21
E132	5679+60	14	9	6	3	0	0	5	8	11	14	21

Table 27. Elevation survey locations, SPS-2 Arizona (Contd.).

Sample Location Designation	Station	Rt. Offset, Center Line, Feet					Lt. Offset, Lane Edge, Feet					Test Section
		1	2	3	4	5	1	2	3	4	5	
E133	5681+95	14	9	6	3	0	0	5	8	11	14	13
E134	5682+45	14	9	6	3	0	0	5	8	11	14	13
E135	5682+95	14	9	6	3	0	0	5	8	11	14	13
E136	5683+45	14	9	6	3	0	0	5	8	11	14	13
E137	5683+95	14	9	6	3	0	0	5	8	11	14	13
E138	5684+45	14	9	6	3	0	0	5	8	11	14	13
E140	5684+95	14	9	6	3	0	0	5	8	11	14	13
E140	5685+45	14	9	6	3	0	0	5	8	11	14	13
E141	5685+95	14	9	6	3	0	0	5	8	11	14	13
E142	5686+45	14	9	6	3	0	0	5	8	11	14	13
E143	5686+95	14	9	6	3	0	0	5	8	11	14	13
E144	5689+00	14	9	6	3	0	0	5	8	11	14	B31
E145	5689+50	14	9	6	3	0	0	5	8	11	14	B31
E146	5790+00	14	9	6	3	0	0	5	8	11	14	B31
E147	5790+50	14	9	6	3	0	0	5	8	11	14	B31
E148	5791+00	14	9	6	3	0	0	5	8	11	14	B31
E149	5791+50	14	9	6	3	0	0	5	8	11	14	B31
E150	5792+00	14	9	6	3	0	0	5	8	11	14	B31
E151	5792+50	14	9	6	3	0	0	5	8	11	14	B31
E152	5793+00	14	9	6	3	0	0	5	8	11	14	B31
E153	5793+50	14	9	6	3	0	0	5	8	11	14	B31
E154	5794+00	14	9	6	3	0	0	5	8	11	14	B31
E155*	5699+00	14	9	6	3	0	0	5	8	11	14	B35
E156	5699+50	14	9	6	3	0	0	5	8	11	14	B35
E157	5700+00	14	9	6	3	0	0	5	8	11	14	B35
E158	5700+50	14	9	6	3	0	0	5	8	11	14	B35
E159	5701+00	14	9	6	3	0	0	5	8	11	14	B35
E160	5701+50	14	9	6	3	0	0	5	8	11	14	B35
E161	5702+00	14	9	6	3	0	0	5	8	11	14	B35
E162	5702+50	14	9	6	3	0	0	5	8	11	14	B35
E163	5703+00	14	9	6	3	0	0	5	8	11	14	B35
E164	5703+50	14	9	6	3	0	0	5	8	11	14	B35
E165	5704+00	14	9	6	3	0	0	5	8	11	14	B35

Table 27. Elevation survey locations, SPS-2 Arizona (Contd.).

Sample Location Designation	Station	Rt. Offset, Center Line, Feet					Lt. Offset, Lane Edge, Feet					Test Section
		1	2	3	4	5	1	3	3	4	5	
E166	5706+49	12	9	6	3	0	0	3	6	9	12	B36
E167	5706+99	12	9	6	3	0	0	3	6	9	12	B36
E168	5707+49	12	9	6	3	0	0	3	6	9	12	B36
E169	5707+99	12	9	6	3	0	0	3	6	9	12	B36
E170	5708+49	12	9	6	3	0	0	3	6	9	12	B36
E171	5708+99	12	9	6	3	0	0	3	6	9	12	B36
E172	5709+49	12	9	6	3	0	0	3	6	9	12	B36
E173	5709+99	12	9	6	3	0	0	3	6	9	12	B36
E174	5710+49	12	9	6	3	0	0	3	6	9	12	B36
E175	5710+99	12	9	6	3	0	0	3	6	9	12	B36
E176	5711+49	12	9	6	3	0	0	3	6	9	12	B36
E177*	5713+00	12	9	6	3	0	0	3	6	9	12	B32
E178	5713+50	12	9	6	3	0	0	3	6	9	12	B32
E179	5714+00	12	9	6	3	0	0	3	6	9	12	B32
E180	5714+50	12	9	6	3	0	0	3	6	9	12	B32
E181	5715+00	12	9	6	3	0	0	3	6	9	12	B32
E182	5715+50	12	9	6	3	0	0	3	6	9	12	B32
E183	5716+00	12	9	6	3	0	0	3	6	9	12	B32
E184	5716+50	12	9	6	3	0	0	3	6	9	12	B32
E185	5717+00	12	9	6	3	0	0	3	6	9	12	B32
E186	5717+50	12	9	6	3	0	0	3	6	9	12	B32
E187	5718+00	12	9	6	3	0	0	3	6	9	12	B32
E188*	5720+00	14	9	6	3	0	0	5	8	11	14	AZ21
E189	5720+50	14	9	6	3	0	0	5	8	11	14	AZ21
E190	5721+00	14	9	6	3	0	0	5	8	11	14	AZ21
E191	5721+50	14	9	6	3	0	0	5	8	11	14	AZ21
E192	5722+00	14	9	6	3	0	0	5	8	11	14	AZ21
E193	5722+50	14	9	6	3	0	0	5	8	11	14	AZ21
E194	5723+00	14	9	6	3	0	0	5	8	11	14	AZ21
E195	5723+50	14	9	6	3	0	0	5	8	11	14	AZ21
E196	5724+00	14	9	6	3	0	0	5	8	11	14	AZ21
E197	5724+50	14	9	6	3	0	0	5	8	11	14	AZ21
E198	5725+00	14	9	6	3	0	0	5	8	11	14	AZ21

Table 27. Elevation survey locations, SPS-2 Arizona (Contd.).

Sample Location Designation	Station	Rt. Offset, Center Line, Feet					Lt. Offset, Lane Edge, Feet					Test Section
		1	2	3	4	5	1	3	3	4	5	
E199	5727+00	14	9	6	3	0	0	5	8	11	14	AZ22
E200	5727+50	14	9	6	3	0	0	5	8	11	14	AZ22
E201	5728+00	14	9	6	3	0	0	5	8	11	14	AZ22
E202	5728+50	14	9	6	3	0	0	5	8	11	14	AZ22
E203	5729+00	14	9	6	3	0	0	5	8	11	14	AZ22
E204	5729+50	14	9	6	3	0	0	5	8	11	14	AZ22
E205	5730+00	14	9	6	3	0	0	5	8	11	14	AZ22
E206	5730+50	14	9	6	3	0	0	5	8	11	14	AZ22
E207	5731+00	14	9	6	3	0	0	5	8	11	14	AZ22
E208	5731+50	14	9	6	3	0	0	5	8	11	14	AZ22
E209	5732+00	14	9	6	3	0	0	5	8	11	14	AZ22
E210	5734+00	14	9	6	3	0	0	5	8	11	14	AZ23
E211	5734+50	14	9	6	3	0	0	5	8	11	14	AZ23
E212	5735+00	14	9	6	3	0	0	5	8	11	14	AZ23
E213	5735+50	14	9	6	3	0	0	5	8	11	14	AZ23
E214	5736+00	14	9	6	3	0	0	5	8	11	14	AZ23
E215	5736+50	14	9	6	3	0	0	5	8	11	14	AZ23
E216	5737+00	14	9	6	3	0	0	5	8	11	14	AZ23
E217	5737+50	14	9	6	3	0	0	5	8	11	14	AZ23
E218	5738+00	14	9	6	3	0	0	5	8	11	14	AZ23
E219	5738+50	14	9	6	3	0	0	5	8	11	14	AZ23
E220	5739+00	14	9	6	3	0	0	5	8	11	14	AZ23
E221	5741+36	12	9	6	3	0	0	3	6	9	12	AZ24 040260
E222	5741+86	12	9	6	3	0	0	3	6	9	12	AZ24
E223	5742+36	12	9	6	3	0	0	3	6	9	12	AZ24
E224	5742+86	12	9	6	3	0	0	3	6	9	12	AZ24
E225	5743+36	12	9	6	3	0	0	3	6	9	12	AZ24
E226	5743+86	12	9	6	3	0	0	3	6	9	12	AZ24
E227	5744+36	12	9	6	3	0	0	3	6	9	12	AZ24
E228	5744+86	12	9	6	3	0	0	3	6	9	12	AZ24
E229	5745+36	12	9	6	3	0	0	3	6	9	12	AZ24
E220	5745+86	12	9	6	3	0	0	3	6	9	12	AZ24
E221	5746+36	12	9	6	3	0	0	3	6	9	12	AZ24

Summary of Sampling and Testing Quantities

The combined quantities for materials sampling, field testing, and laboratory testing for the SPS-2 experimental projects are contained in Tables 28 - 3. It should be noted that the LTPP sampling and test procedures referenced in these tables and in other portions of this document must be followed in conducting this work. This includes completion and submission of all required data forms.

Table 28. Estimated quantities of laboratory materials testing, SPS-2 Arizona.

	<u>LTPP TEST Designation</u>		<u>LTPP Protocol</u>	<u>No.</u>
SUBGRADE				
Sieve Analysis	SS01	P51	11	
Hydrometer to 0.01mm	SS02	P42	11	
Atterberg Limits	SS03	P43	11	
Classification and Type of Subgrade	SS04	P52	41	
Moisture-Density Relations	SS05	P55	11	
Resilient Modulus	SS07	Ship to FHWA Lab . . .	10	
Unit Weight	SS08	P56	30	
Natural Moisture Content	SS09	P49	11	
Unconfined Compressive Strength	SS10	P54	10	
Permeability	SS11	P57	6	
In-Place Density		LTPP Method	74	
Depth to Rigid Layer		LTPP Method	10	
Plate Bearing Testing	SS06	P58	6	
DENSE GRADED AGGREGATE BASE				
Particle Size Analysis	UG01	P41	7	
Sieve Analysis (Washed)	UG02	P41	7	
Atterberg Limits	UG04	P43	7	
Moisture-Density Relations	UG05	P44	7	
Resilient Modulus	UG07	Ship to FHWA Lab . . .	7	
Classification	UG08	P47	7	
Permeability	UG09	P48	7	
Natural Moisture Content	UG10	P49	7	
In-Place Density		LTPP Method	42	
Plate Bearing Test	SS06	P58	4	

Table 28. Estimated quantities of laboratory materials testing, SPS-2 Arizona (Contd.).

	<u>LTPP TEST Designation</u>		<u>LTPP Protocol</u>	<u>No.</u>
PERMEABLE BITUMINOUS TREATED BASE				
Core Examination/Thickness	AC01	P01	24	
Bulk Specific Gravity	AC02	P02	24	
Maximum Specific Gravity	AC03	P03	4	
Asphalt Content (Extraction)	AC04	P04	4	
Moisture Susceptibility	AC05	P05	4	
Permeability/Flow	AC08	P08	1	
Resilient Modulus	AC07	Ship to FHWA Lab	6	
Indirect Tensile Strength	AC07	Ship to FHWA Lab	24	
Plate Bearing Test	SS06	P58	3	
Extracted Aggregate				
Specific Gravity Coarse Aggregate	AG01	P11	1	
Specific Gravity Fine Aggregate	AG02	P12	1	
Type and Class Coarse Aggregate	AG03	P13	1	
Type and Class Fine Aggregate	AG03	P13	1	
Aggregate Gradation	AG04	P14	1	
NAA Test for Fine Aggregate Particle Shape	AG05	P14A	1	
Coarse Aggregate Particle Shape	AG06	P14B	1	
Asphalt Cement				
Abson Recovery	AE01	P21	1	
Penetration @ 50F, 77F, 90F	AE02	P22	1	
Specific Gravity (60F)	AE03	P23	1	
Viscosity @ 77F	AE04	P24	1	
Viscosity @ 140F, 275F	AE05	P25	1	
Asphalt Cement (from plant)				
Penetration @ 50F, 77F, 90F	AE02	P22	1	
Specific Gravity (60F)	AE03	P23	1	
Viscosity @ 77F	AE04	P24	1	
Viscosity @ 104F, 275F	AE05	P25	1	

Table 28. Estimated quantities of laboratory materials testing, SPS-2 Arizona (Contd.).

	<u>LTPP TEST Designation</u>		<u>LTPP Protocol</u>	<u>No.</u>
BITUMINOUS TREATED BASE				
Core Examination/Thickness	AC01	P01	12	
Bulk Specific Gravity	AC02	P02	12	
Maximum Specific Gravity	AC03	P03	2	
Asphalt Content (Extraction)	AC04	P04	2	
Moisture Susceptibility	AC05	P05	1	
Resilient Modulus	AC07	Ship to FHWA Lab	3	
Indirect Tensile Strength	AC07	Ship to FHWA Lab	12	
In-place Density		LTPP Method	15	
Plate Bearing Test	SS06	P58	1	
Extracted Aggregate				
Specific Gravity Coarse Aggregate	AG01	P11	1	
Specific Gravity Fine Aggregate	AG02	P12	1	
Type and Class Coarse Aggregate	AG03	P13	1	
Type and Class Fine Aggregate	AG03	P13	1	
Aggregate Gradation	AG04	P14	1	
NAA Test for Fine Aggregate Particle Shape	AG05	P14A	1	
Coarse Aggregate Particle Shape	AG06	P14B	1	
Asphalt Cement				
Abson Recovery	AE01	P21	2	
Penetration @ 50F, 77F, 90F	AE02	P22	2	
Specific Gravity (60F)	AE03	P23	2	
Viscosity @ 77F	AE04	P24	2	
Viscosity @ 140F, 275F	AE05	P25	2	
Asphalt Cement (from plant)				
Penetration @ 50F, 77F, 90F	AE02	P22	2	
Specific Gravity (60F)	AE03	P23	2	
Viscosity @ 77F	AE04	P24	2	
Viscosity @ 104F, 275F	AE05	P25	2	

Table 28. Estimated quantities of laboratory materials testing, SPS-2 Arizona (Contd.).

	<u>LTPP TEST Designation</u>		<u>LTPP Protocol</u>	<u>No.</u>
ASPHALT CONCRETE				
Core Examination/Thickness	AC01	P01	12	
Bulk Specific Gravity	AC02	P02	12	
Maximum Specific Gravity	AC03	P03	2	
Asphalt Content (Extraction)	AC04	P04	2	
Moisture Susceptibility	AC05	P05	2	
Creep Modulus	AC06	Ship to FHWA Lab	1	
Resilient Modulus	AC07	Ship to FHWA Lab	2	
Indirect Tensile Strength	AC07	Ship to FHWA Lab	8	
In-place Density		LTPP Method		10
Extracted Aggregate				
Specific Gravity Coarse Aggregate	AG01	P11	2	
Specific Gravity Fine Aggregate	AG02	P12	2	
Type and Class Coarse Aggregate	AG03	P13	2	
Type and Class Fine Aggregate	AG03	P13	2	
Aggregate Gradation	AG04	P14	2	
NAA Test for Fine Aggregate Particle Shape	AG05	P14A	2	
Coarse Aggregate Particle Shape	AG06	P14B	2	
Asphalt Cement				
Abson Recovery	AE01	P21	2	
Penetration @ 50F, 77F, 90F	AE02	P22	2	
Specific Gravity (60F)	AE03	P23	2	
Viscosity @ 77F	AE04	P24	2	
Viscosity @ 140F, 275F	AE05	P25	2	
Asphalt Cement (from plant)				
Penetration @ 50F, 77F, 90F	AE02	P22	2	
Specific Gravity (60F)	AE03	P23	2	
Viscosity @ 77F	AE04	P24	2	
Viscosity @ 104F, 275F	AE05	P25	2	

Table 29. Estimated laboratory testing quantities, Lean Concrete Base and PCC molded samples, SPS-2 Arizona.

	<u>LTPP TEST Designation</u>	<u>LTPP Protocol</u>	<u>No.</u>
LEAN CONCRETE BASE - AS DELIVERED			
Compressive Strength	PC01	P61	
7 day			6
28 day			6
1 year			6
PORLAND CEMENT CONCRETE - AS DELIVERED			
Compressive Strength	PC01	P61	
14 day			9
28 day			9
1 year			9
Splitting Tensile Strength	PC02	P62	
14 day			9
28 day			9
1 year			9
Flexural Strength	PC09	P69	
14 day			9
28 day			9
1 year			9
Air Content		ASTM C231	9
Slump		ASTM C143	9
Temperature		ASTM C1064	9

Table 30. Estimated quantities of laboratory materials testing on cores of lean concrete base and portland cement concrete for SPS-2 Arizona.

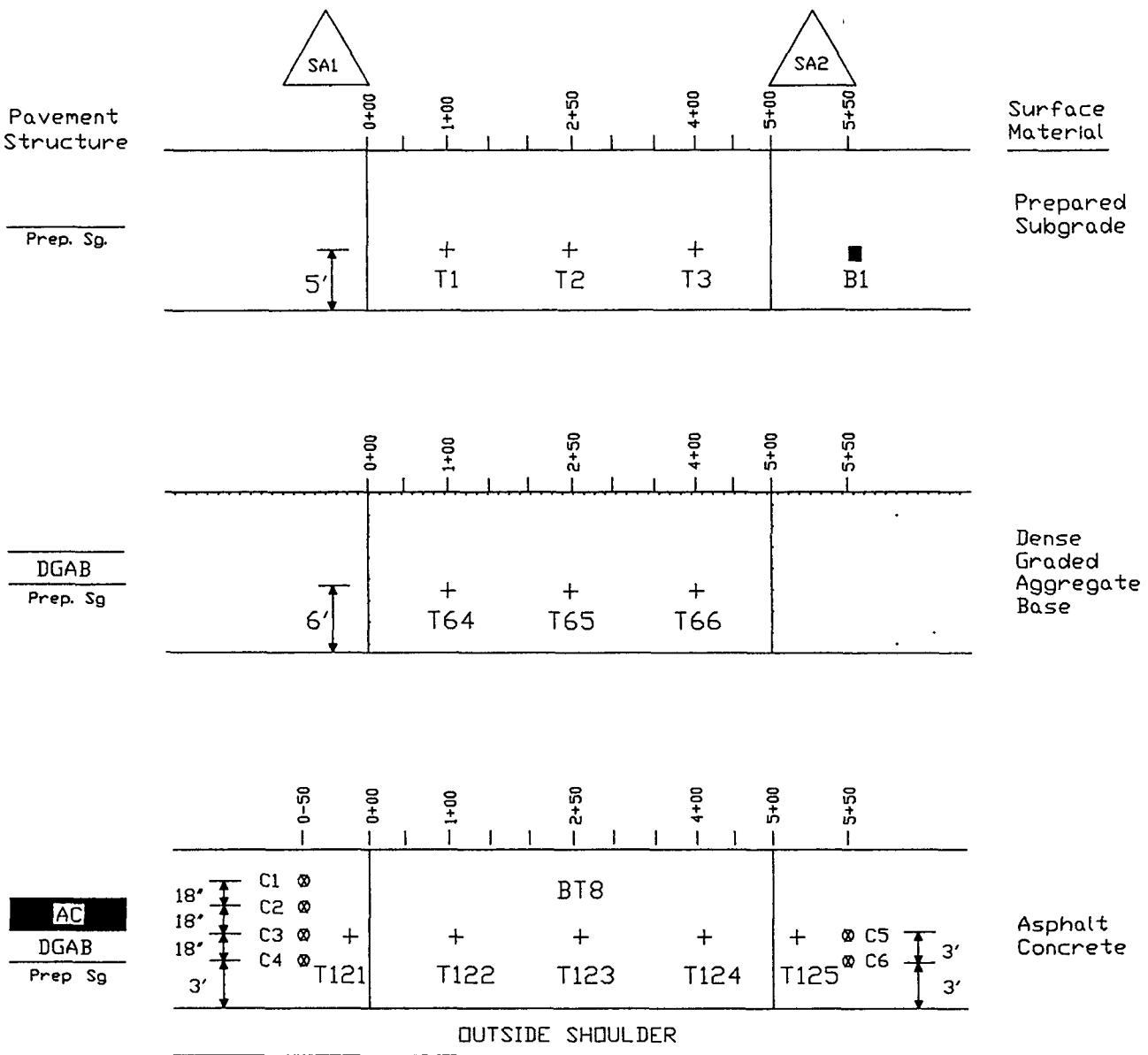
	<u>LTPP TEST Designation</u>	<u>LTPP Protocol</u>	<u>No.</u>
LEAN CONCRETE BASE - AS PLACED			
Compressive Strength	PC01	P61	
14 day			6
28 day			6
1 year			6
PORLAND CEMENT CONCRETE - AS PLACED			
Compressive Strength	PC01	P61	
14 day			19
28 day			19
1 year			19
Splitting Tensile Strength	PC02	P62	
14 day			19
28 day			19
1 year			19
PCC Unit Weight	PC05	P65	48
Static Modulus of Elasticity	PC04	P64	
28 day			18
1 year			18
Air Content @ 28 days	PC08	P68	3
PCC Coefficient of Thermal Expansion	PC03	Ship to FHWA	3

Table 31. Estimated quantities for material sampling and other field tests.

	<u>Quantity</u>	<u>Units</u>
Portland Cement Concrete		
Coring - 4" diam. cores	1,616	Linear Inches
Bulk Sampling	9	Number (molded into test specimens)
Asphalt Concrete		
Bulk samples of AC Mix	3	Samples
Samples of Asphalt Cement	13	Samples
Bulk sample of Aggregate	1	Sample
Nuclear Density Tests	10	Locations
Dense Graded Aggregate Base		
Bulk Sampling	7	Samples
Nuclear Moisture-Density Tests	42	Number
Lean Concrete Base		
Bulk Sampling	3	Samples
Coring	108	Linear Inches
Permeable Asphalt Treated Base		
Bulk Sampling	4	Samples
Coring	96	Linear Inches
Asphalt Cement Bulk Sample	1	Sample
Bituminous Treated Base		
Bulk Sampling	2	Samples
Coring	48	Linear Inches
Nuclear Density Tests	15	Locations
Asphalt Cement Bulk Samples	2	Samples
Subgrade		
Thin-walled tube sampling	30	Samples
Bulk Sampling	11	Samples
Nuclear Moisture-Density Tests	74	Locations
Shoulder Auger Probes	200	Linear Feet
Plate Bearing Tests	14	Locations
Elevation Surveys	345	Person-Hours
(5 person hours per section per layer, ~60 points/section/layer)		

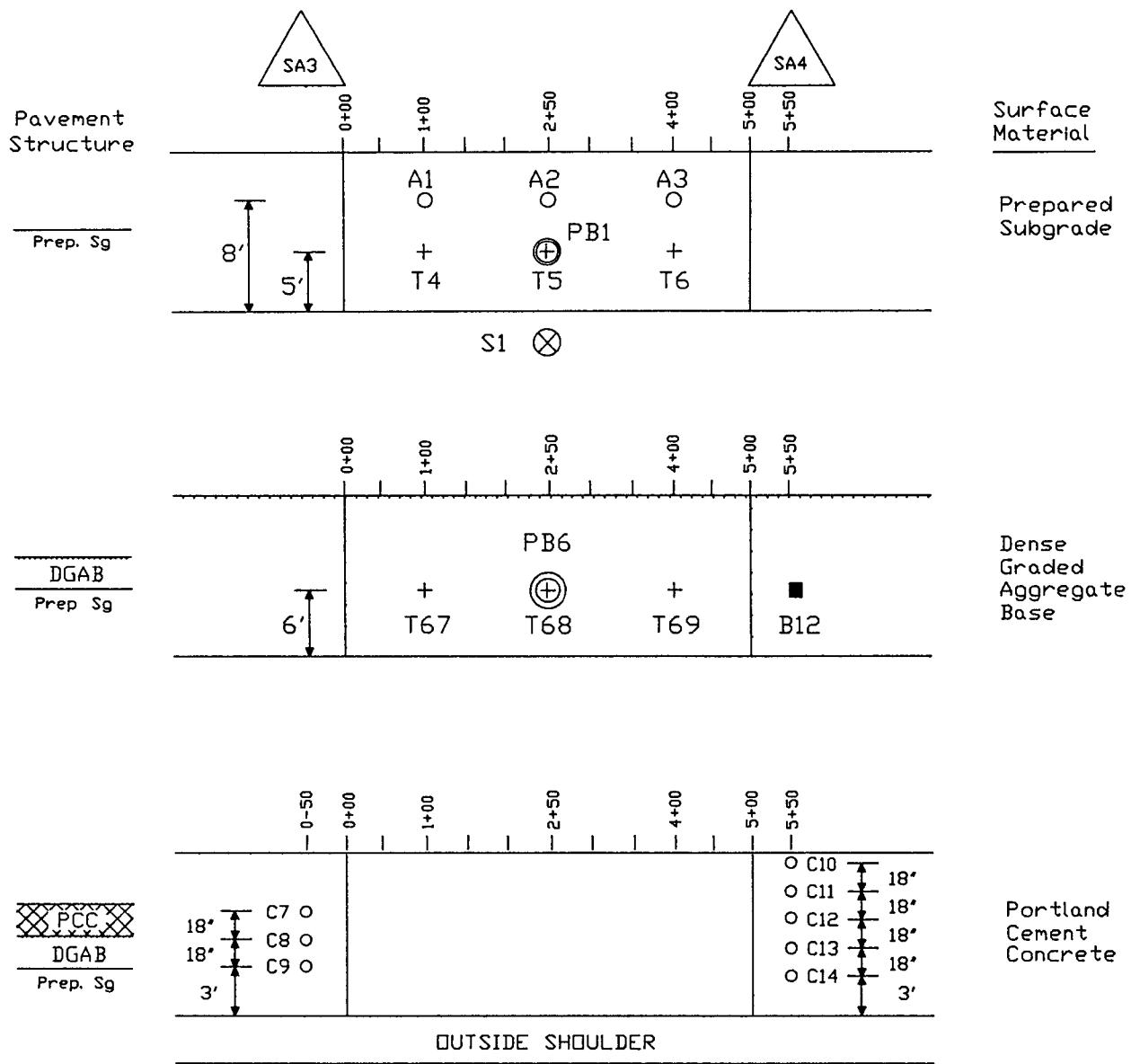
Sampling and Testing Summary by Test Section

Figures 6 through 26 illustrate the sampling and test details for each test section. In these figures, the material layer present during the various construction stages are shown starting with the surface of the prepared subgrade. Locations are specified by the test section stations relative to the beginning and end of the monitoring portion of each test section. The construction stations of the beginning and end of the monitoring portion of the test section are shown for reference. The only measurements not shown in these figures are the elevation surveys to be performed on the finished surface of each material layer. The further details associated with the sampling and testing shown in these figures are provided in the tables presented in the following portion of this document arranged by layer material type.



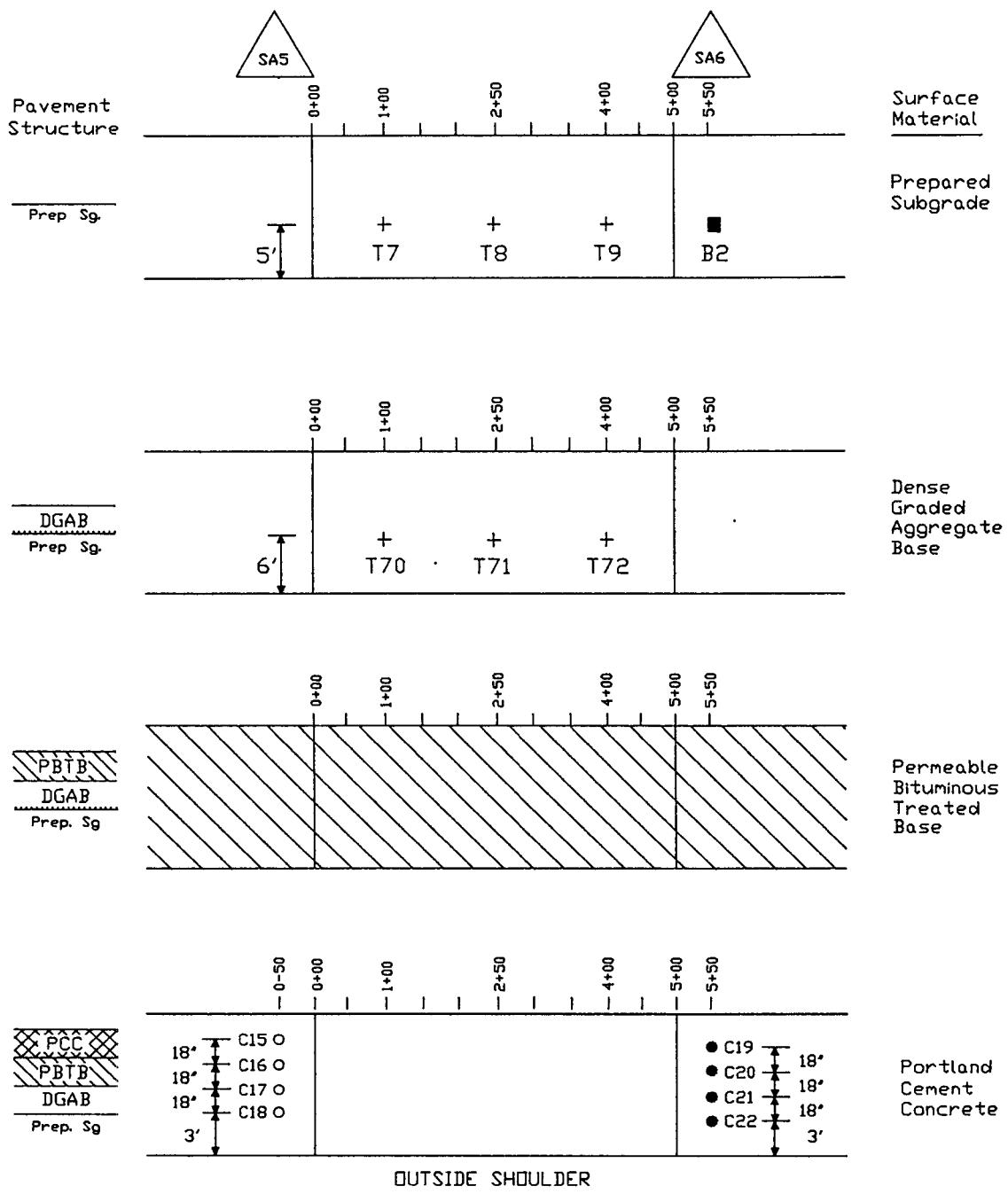
T1-T3 - Nuclear moisture-density tests on Subgrade
 B1 - Bulk sample of Subgrade
 BT8 - Bulk sample of AC
 PB1 - Plate bearing test on Subgrade
 T64-T66 - Nuclear moisture-density tests on DGAB
 T121-T125 - Nuclear density test on AC
 C1-C6 - Cores of AC surface only

Figure 6. Sampling and test plan for test section 040261 (AZ24), SPS-2 Arizona.



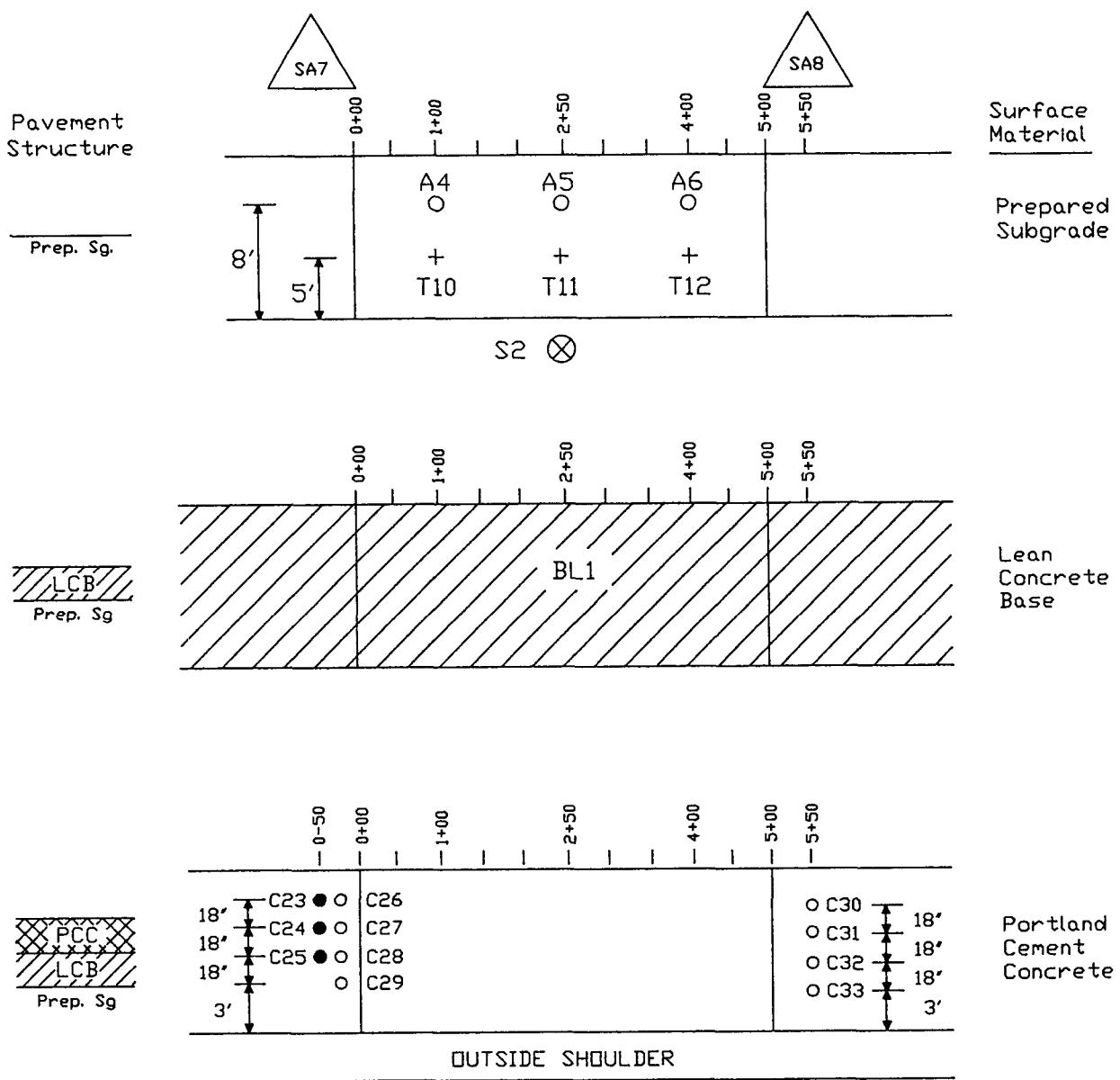
- PB1 - Plate bearing test on subgrade surface
 S1 - 20' Shoulder probe
 T4-T6 - Nuclear moisture-density tests on Subgrade
 A1-A3 - Thinwall sampling of Subgrade
 T67-T69 - Nuclear moisture-density tests on DGAB
 B12 - Bulk sample of DGAB
 PB6 - Plate bearing test on DGAB
 C7-C14 - Cores of PCC surface only

Figure 7. Sampling and test plan for test section 040214, SPS-2 Arizona.



T7-T9 - Nuclear moisture-density tests on Subgrade
 B2 - Bulk sample of Subgrade
 T70-T72 - Nuclear moisture-density test on DGAB
 C15-C18 - Cores of PCC surface only
 C19-C22 - Cores of PCC surface and bound layers

Figure 8. Sampling and test plan for test section 040222, SPS-2 Arizona.



S2 - 20' Shoulder probe

T10-T12 - Nuclear moisture-density tests on Subgrade

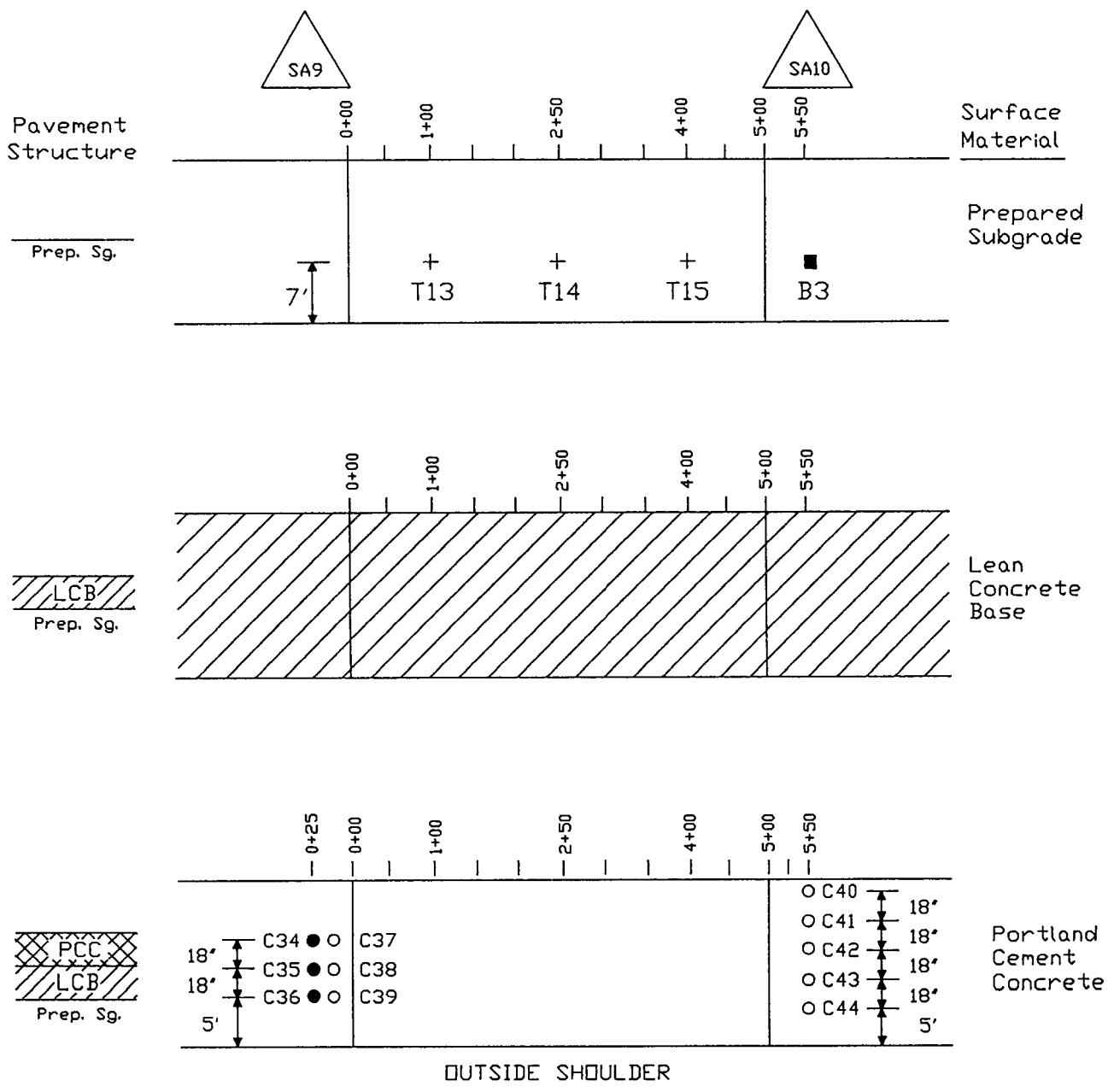
A4-A6 - Thinwall sampling of Subgrade

C23-C25 - Cores of PCC surface and LCB layer

C26-C29 - Cores of PCC surface only

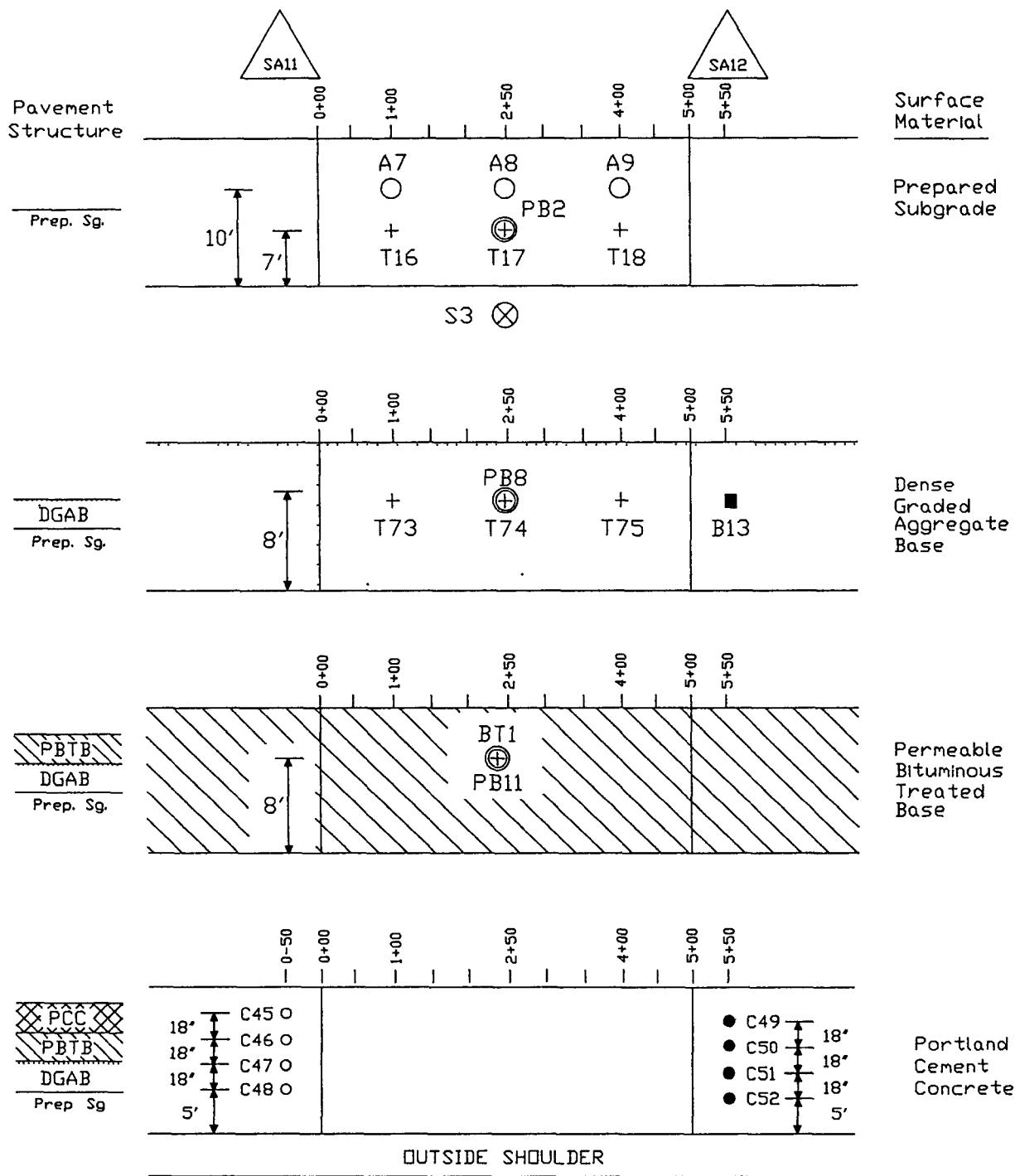
BL1 - Bulk sample of LCB

Figure 9. Sampling and test plan for test section 040218, SPS-2 Arizona.



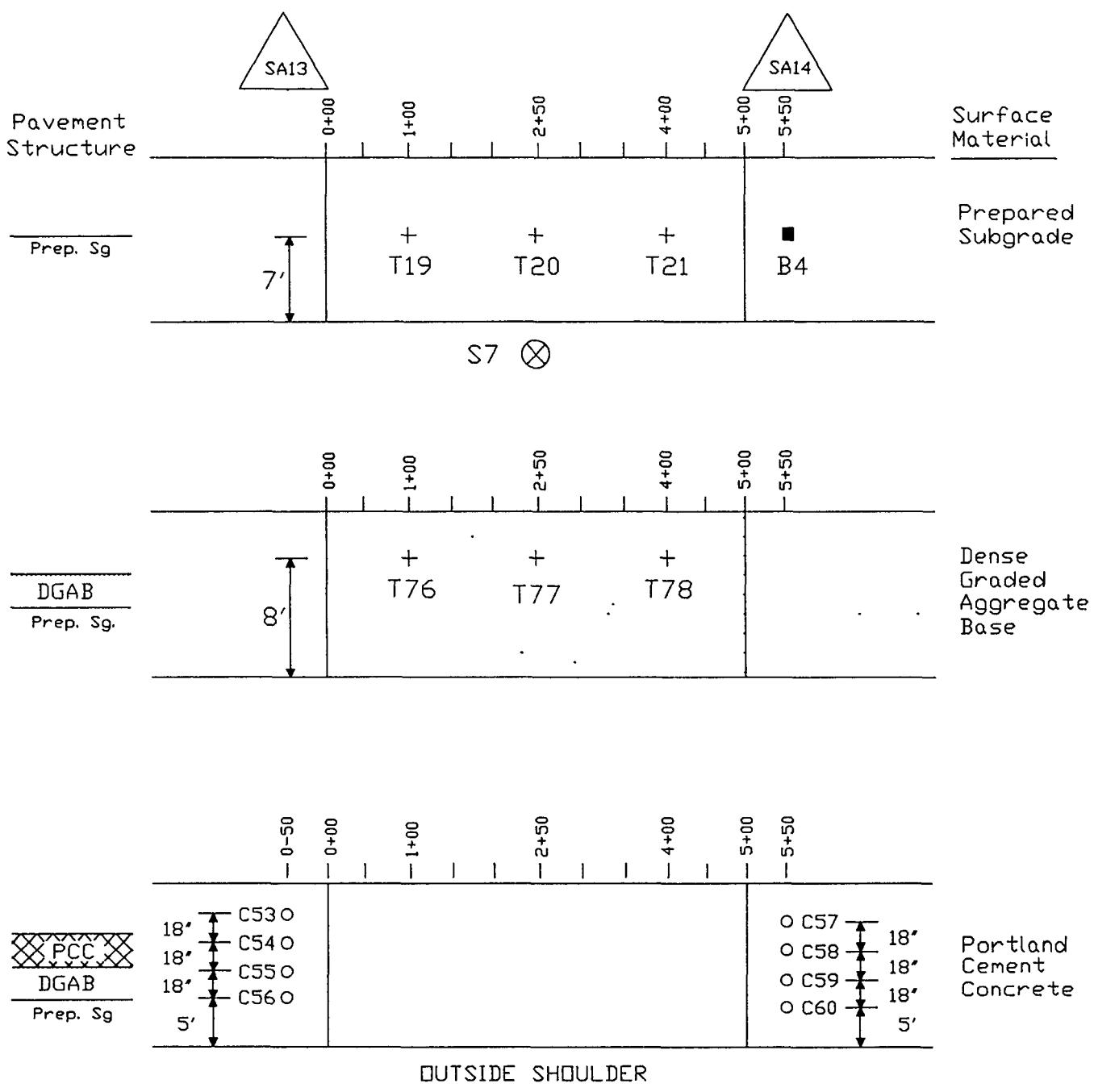
T13-T15 - Nuclear moisture-density tests on Subgrade
 B3 - Bulk sample of Subgrade
 C34-C36 - Cores of PCC surface and bound layer
 C37-C44 - Cores of PCC surface only

Figure 10. Sampling and test plan for test section 040220, SPS-2 Arizona.



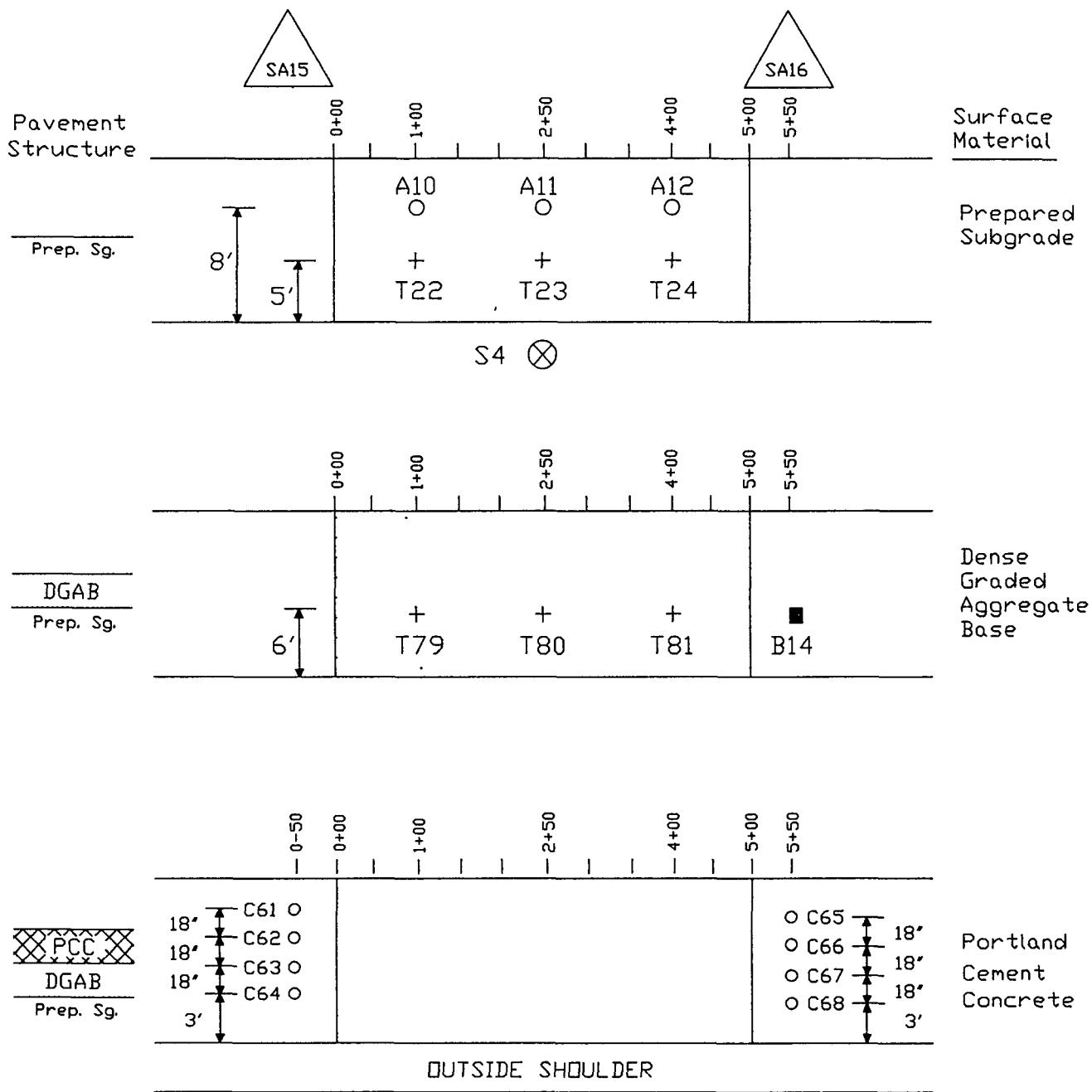
S3 - 20' Shoulder probe
 T16-T18 - Nuclear moisture-density tests on Subgrade
 A7-A9 - Thinwall sampling of Subgrade
 T73-T75 - Nuclear moisture-density tests on AB
 B13 - Bulk sample of AB
 BT1 - Bulk sample of PBTB
 PB2, PB8, PB11 - Plate bearing tests
 C45-C48 - Cores of PCC surface only
 C49-C52 - Cores of PCC surface and bound layers

Figure 11. Sampling and test plan for test section 040224, SPS-2 Arizona.



T19-T21 - Nuclear moisture-density tests on Subgrade
 B4 - Bulk sample of Subgrade
 T76-T78 - Nuclear moisture-density tests on DGAB
 C53-C60 - Cores of PCC surface only

Figure 12. Sampling and test plan for test section 040216, SPS-2 Arizona.



S4 - 20' Shoulder probe

T22-T24 - Nuclear moisture-density tests on Subgrade

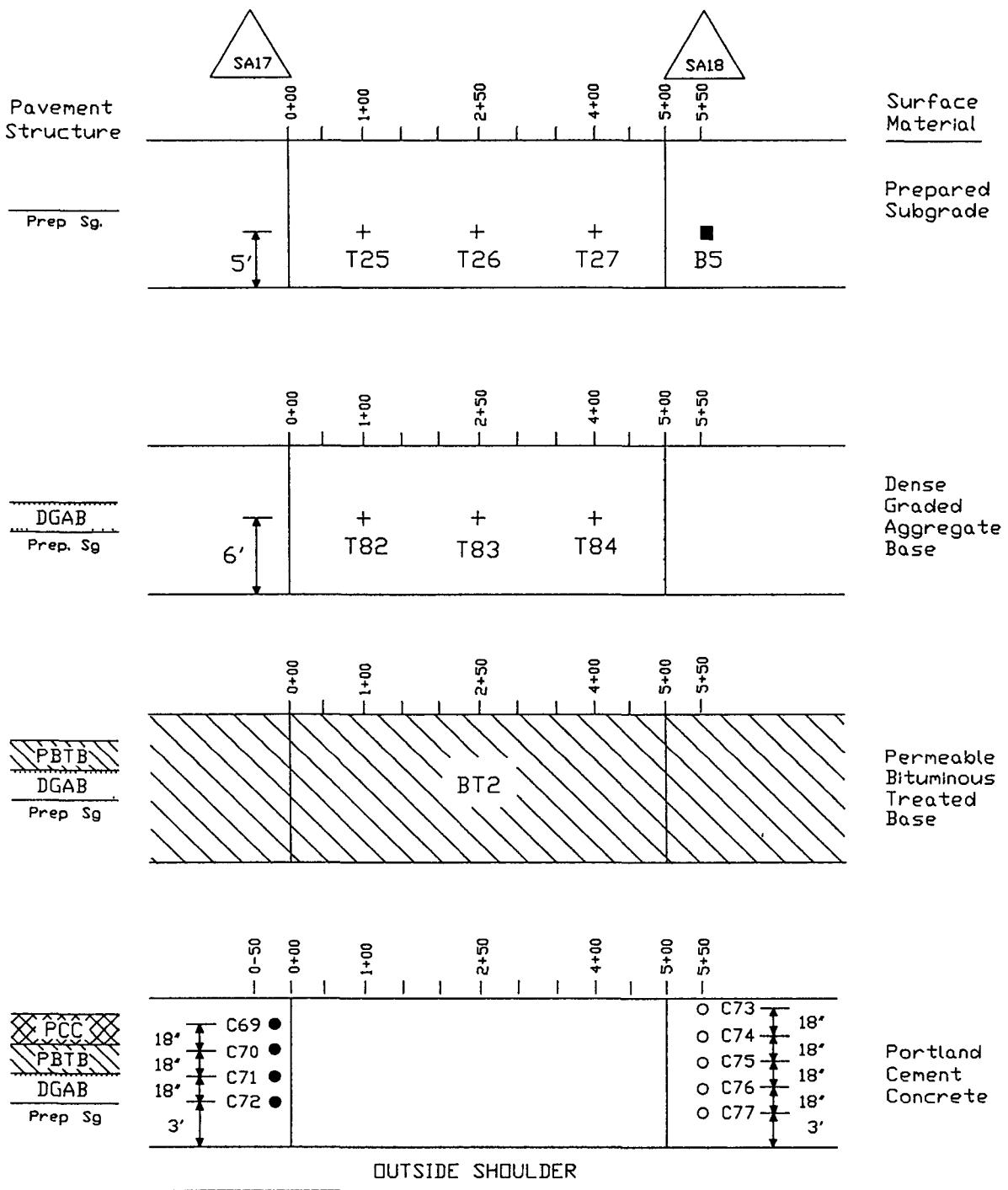
A10-A12 - Thinwall sampling of Subgrade

T79-T81 - Nuclear moisture density tests on DGAB

B14 - Bulk sample of DGAB

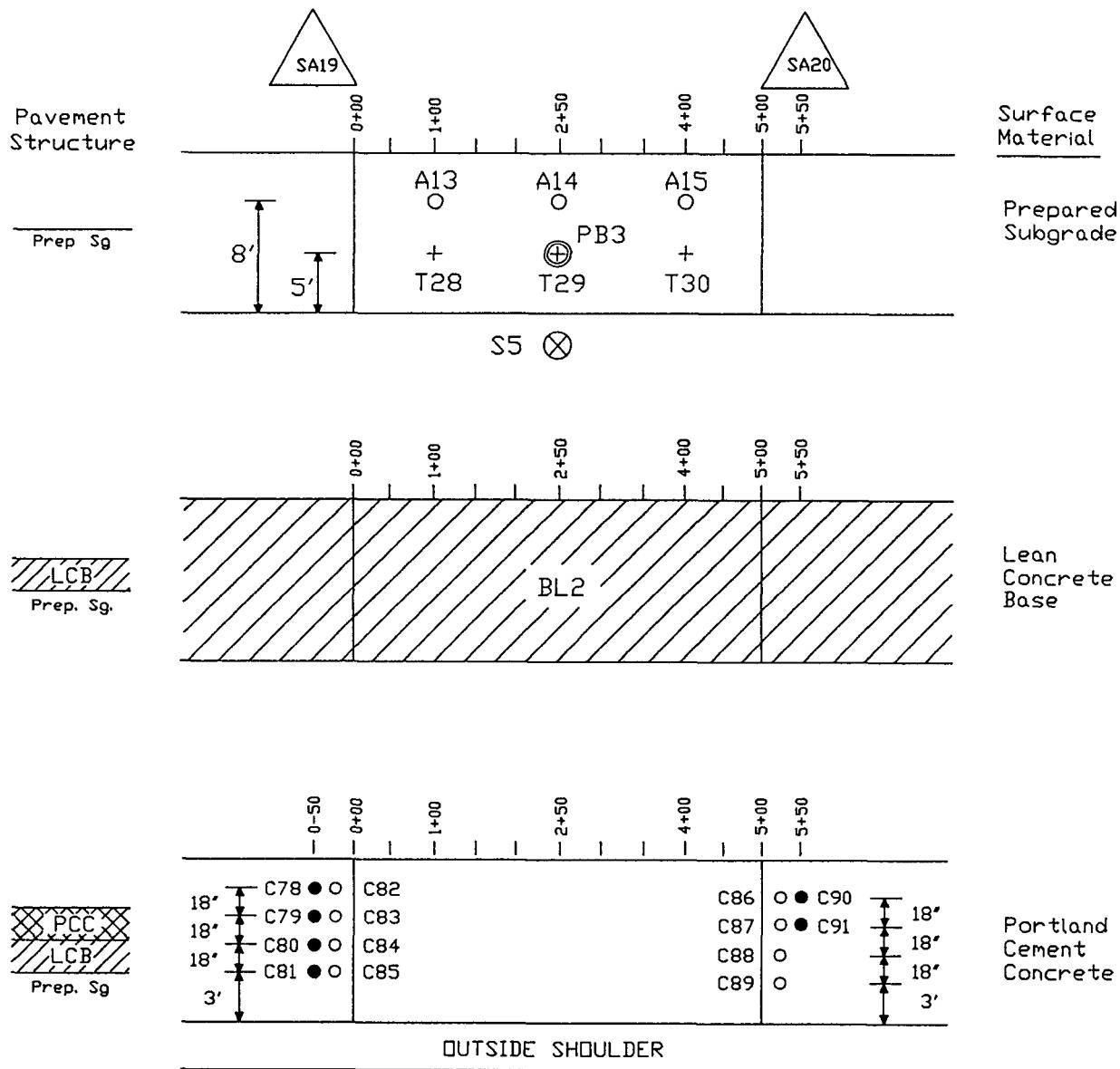
C61-C68 - Cores of PCC surface only

Figure 13. Sampling and test plan for test section 040215, SPS-2 Arizona.



T25-T27 - Nuclear moisture-density tests on Subgrade
 B5 - Bulk sample of Subgrade
 T82-T84 - Nuclear moisture-density tests on DGAB
 BT2 - Bulk sample of PBTB
 PB8 - Plate bearing test on DGAB
 C69-C72 - Cores of PCC surface and bound layer
 C73-C77 - Cores of PCC surface only

Figure 14. Sampling and test plan for test section 040223, SPS-2 Arizona.



S5 - 20' Shoulder probe

PB3 - Plate bearing test on subgrade

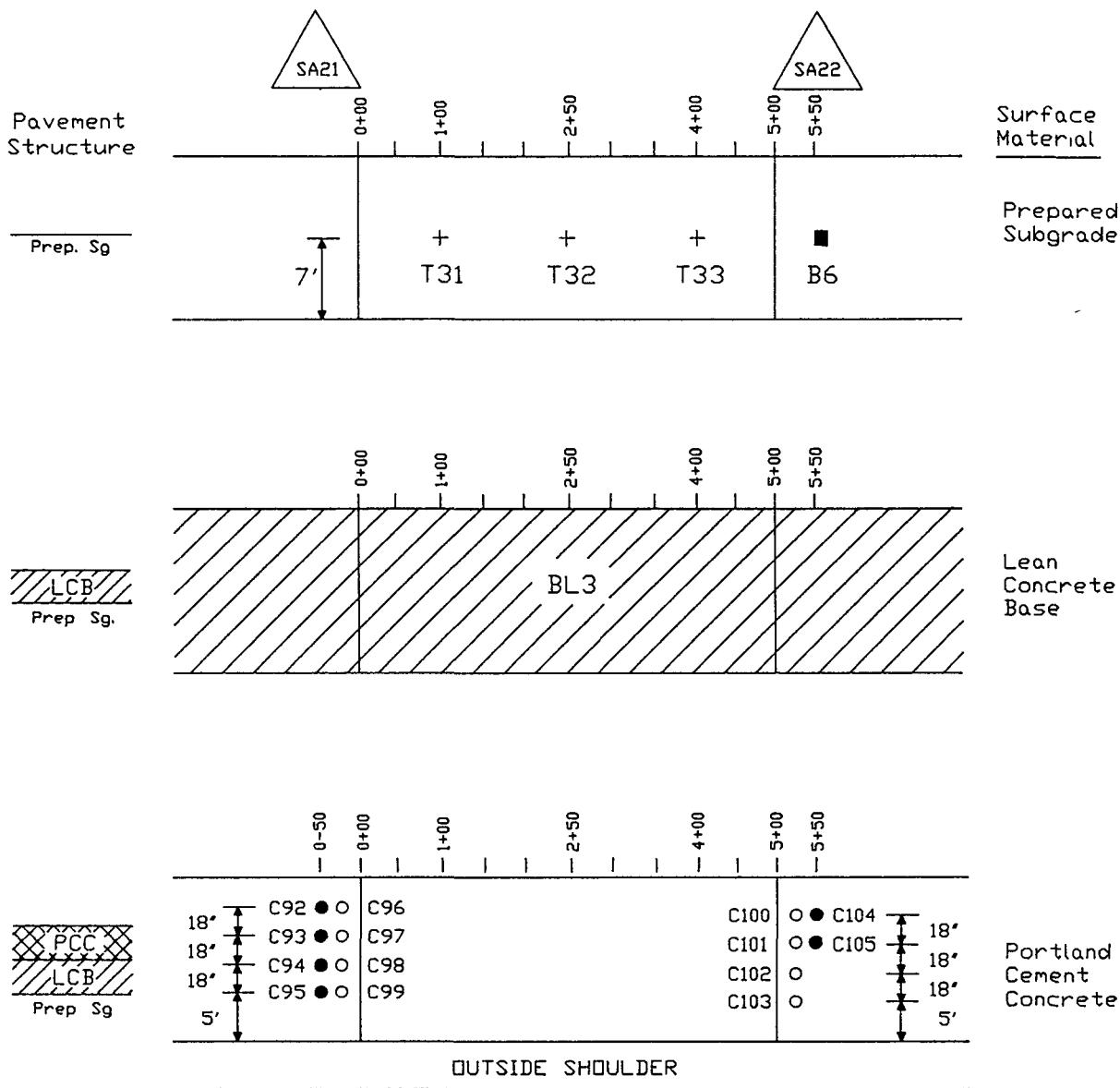
T28-T30 - Nuclear moisture-density tests on Subgrade

A13-A15 - Thinwall tube sampling of Subgrade

C78-C81, C90-C91 - Cores of PCC surface and LCB layer

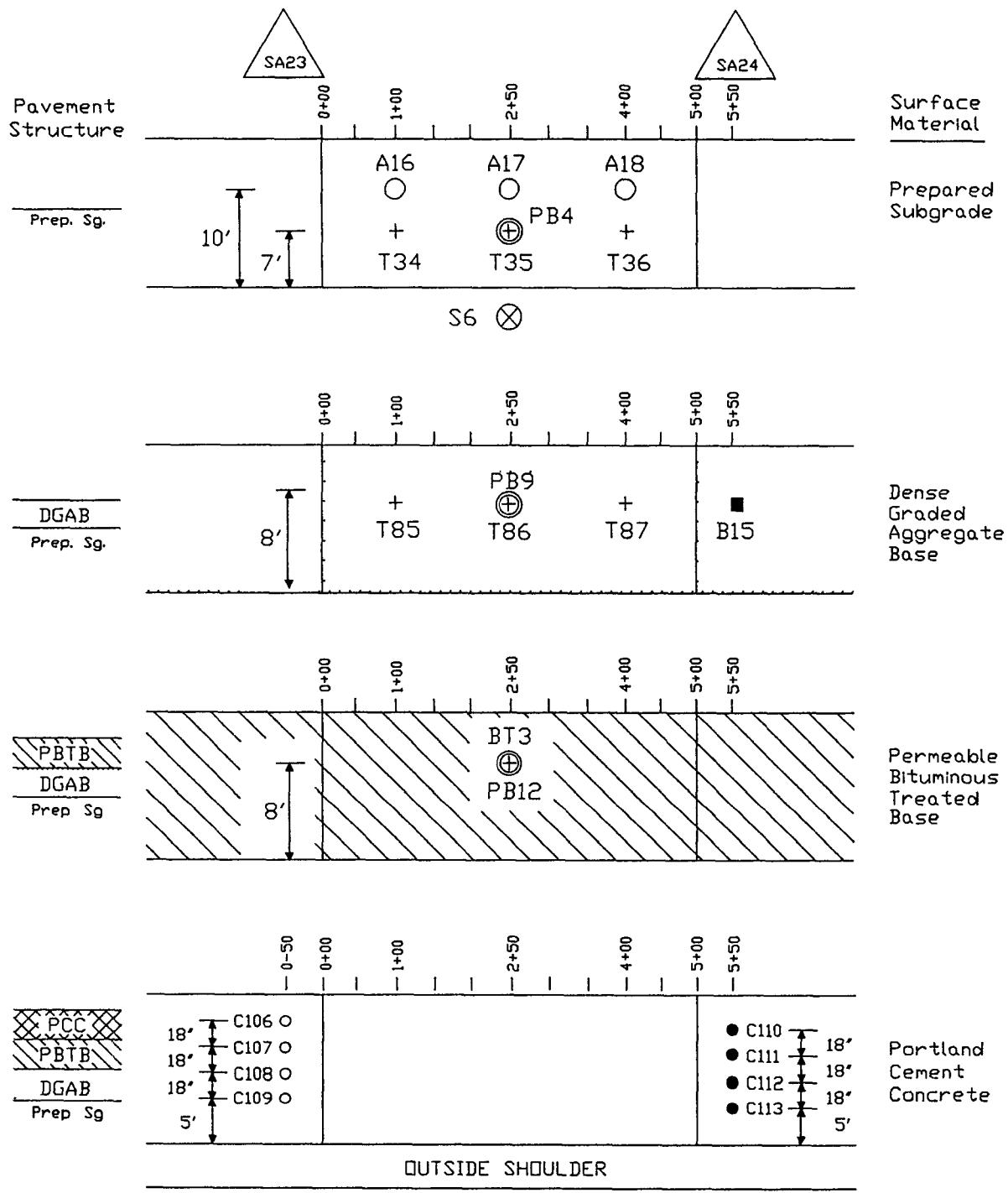
C82-C89 - Cores of PCC surface only

Figure 15. Sampling and test plan for test section 040219, SPS-2 Arizona.



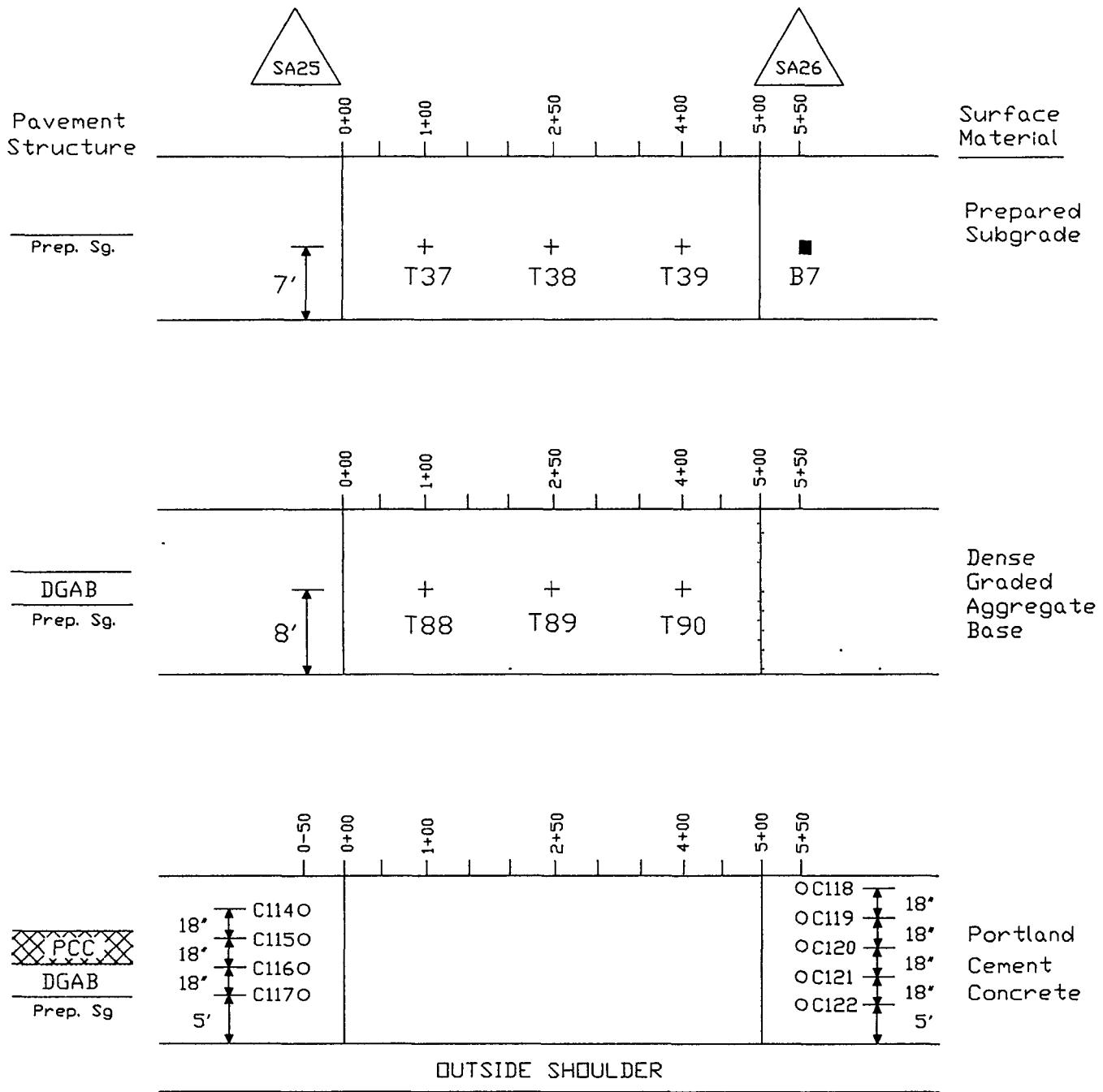
S11 - 20' Shoulder probe
 T31-T33 - Nuclear moisture-density tests on Subgrade
 B6 - Bulk sample of Subgrade
 C92-C95, C104-C105, Cores of PCC surface and bound layer
 C96-C103 - Cores of PCC surface only
 BL3 - Bulk sample of LCB

Figure 16. Sampling and test plan for test section 040217, SPS-2 Arizona.



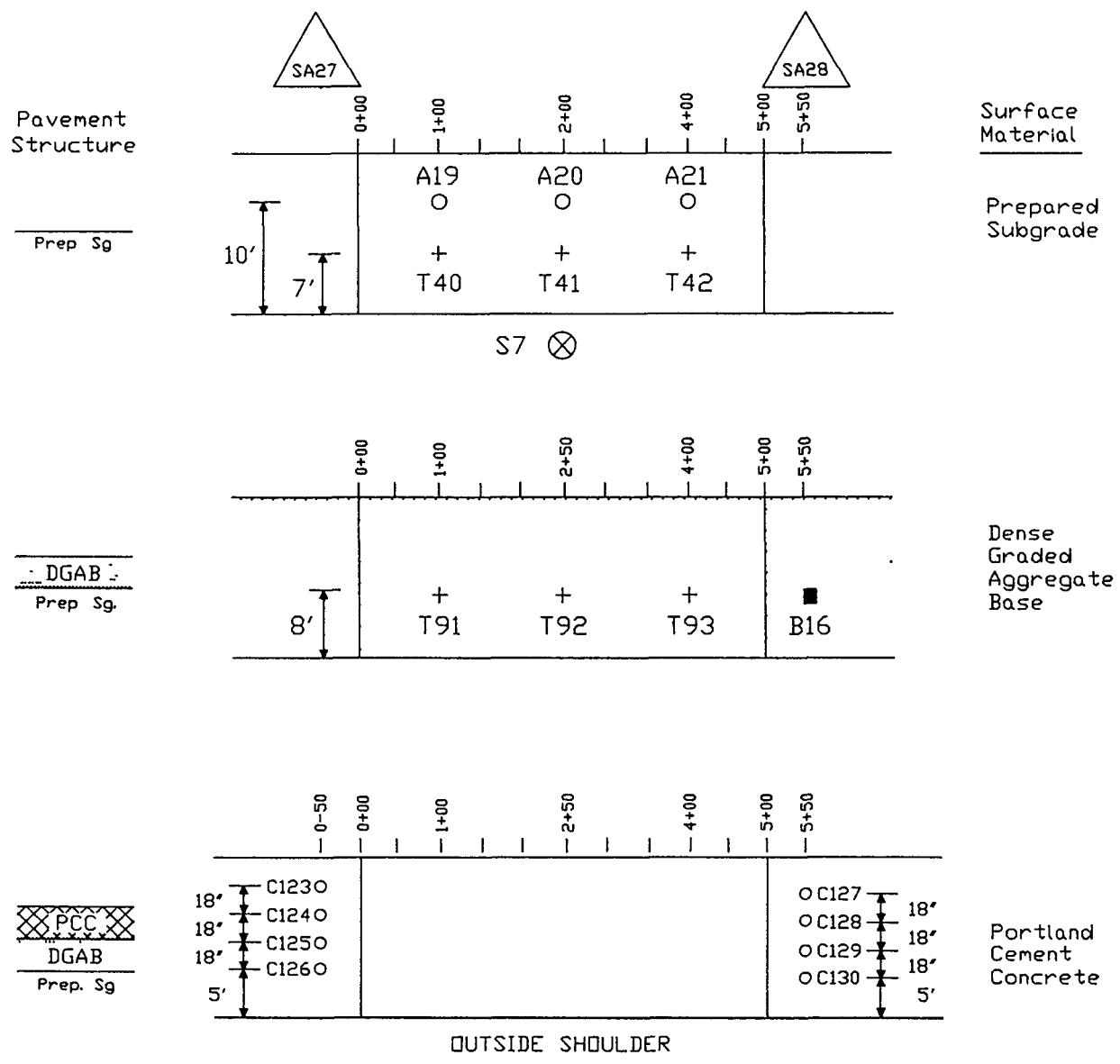
S6 - 20' Shoulder probe
T34-T36 - Nuclear moisture-density tests on Subgrade
A16-A18 - Thinwall tube sampling of subgrade
T85-T87 - Nuclear moisture-density tests on DGAB
B15 - Bulk sample of DGAB
BT3 - Bulk sample of PBTB
PB4, PB9, PB12 - Plate bearing tests
C106-C109 - Cores of PCC surface only
C110-C113 - Cores of PCC surface and PBTB layer

Figure 17. Sampling and test plan for test section 040121, SPS-2 Arizona.



T37-T39 - Nuclear moisture-density tests on Subgrade
 B7 - Bulk sample of Subgrade
 T88-T90 - Nuclear moisture-density tests on DGAB
 C114-C122 - Cores of PCC surface only

Figure 18. Sampling and test plan for test section 040213, SPS-2 Arizona.



S7 - 20' Shoulder probe

T40-T42 - Nuclear moisture-density tests on Subgrade

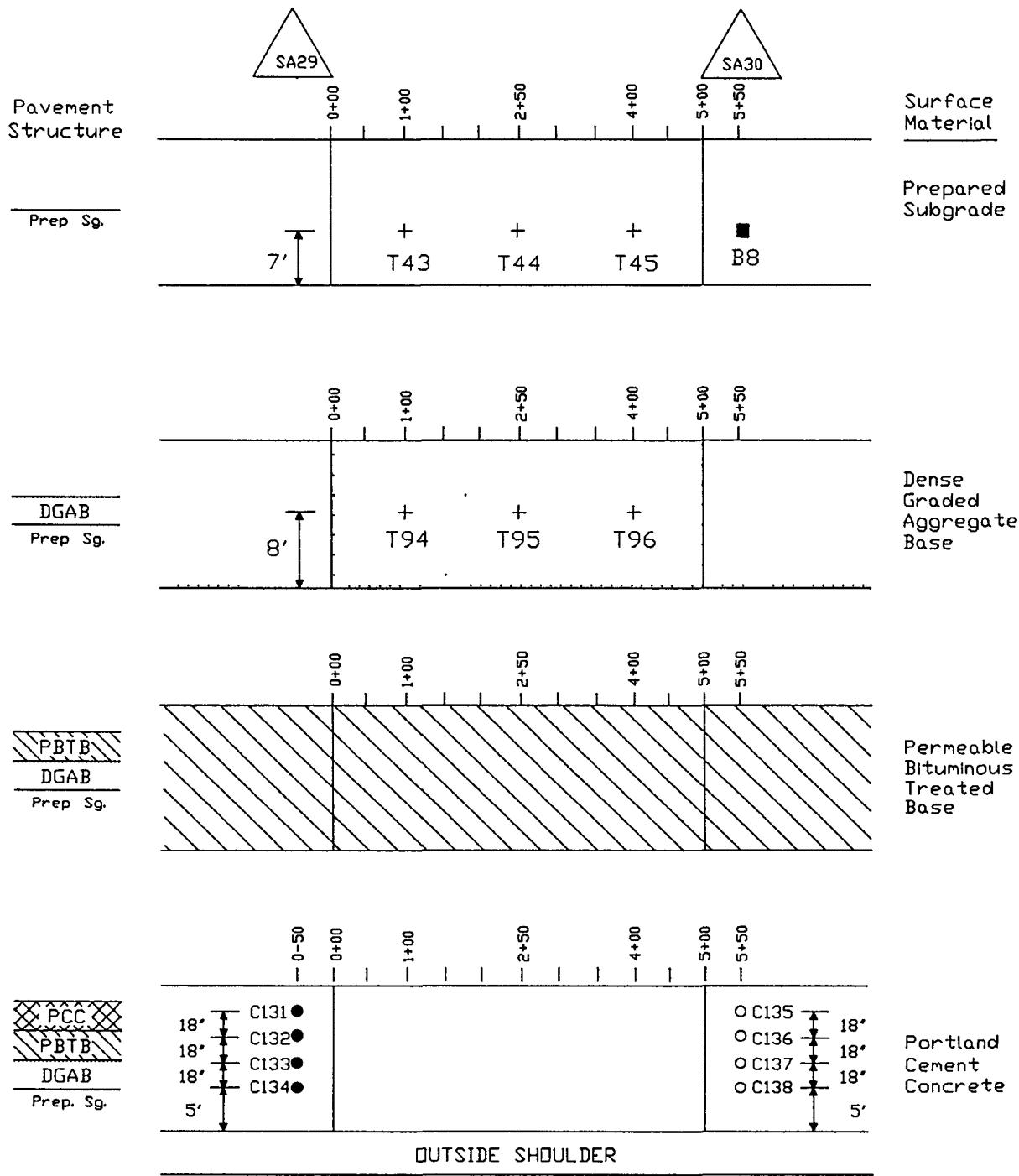
A19-A21 - Thinwall tube sampling of Subgrade

T91-T93 - Nuclear moisture-density tests on DGAB

B16 - Bulk sample of DGAB

C123-C130 - Cores of PCC surface only

Figure 19. Sampling and test plan for test section 040253 (B31), SPS-2 Arizona.



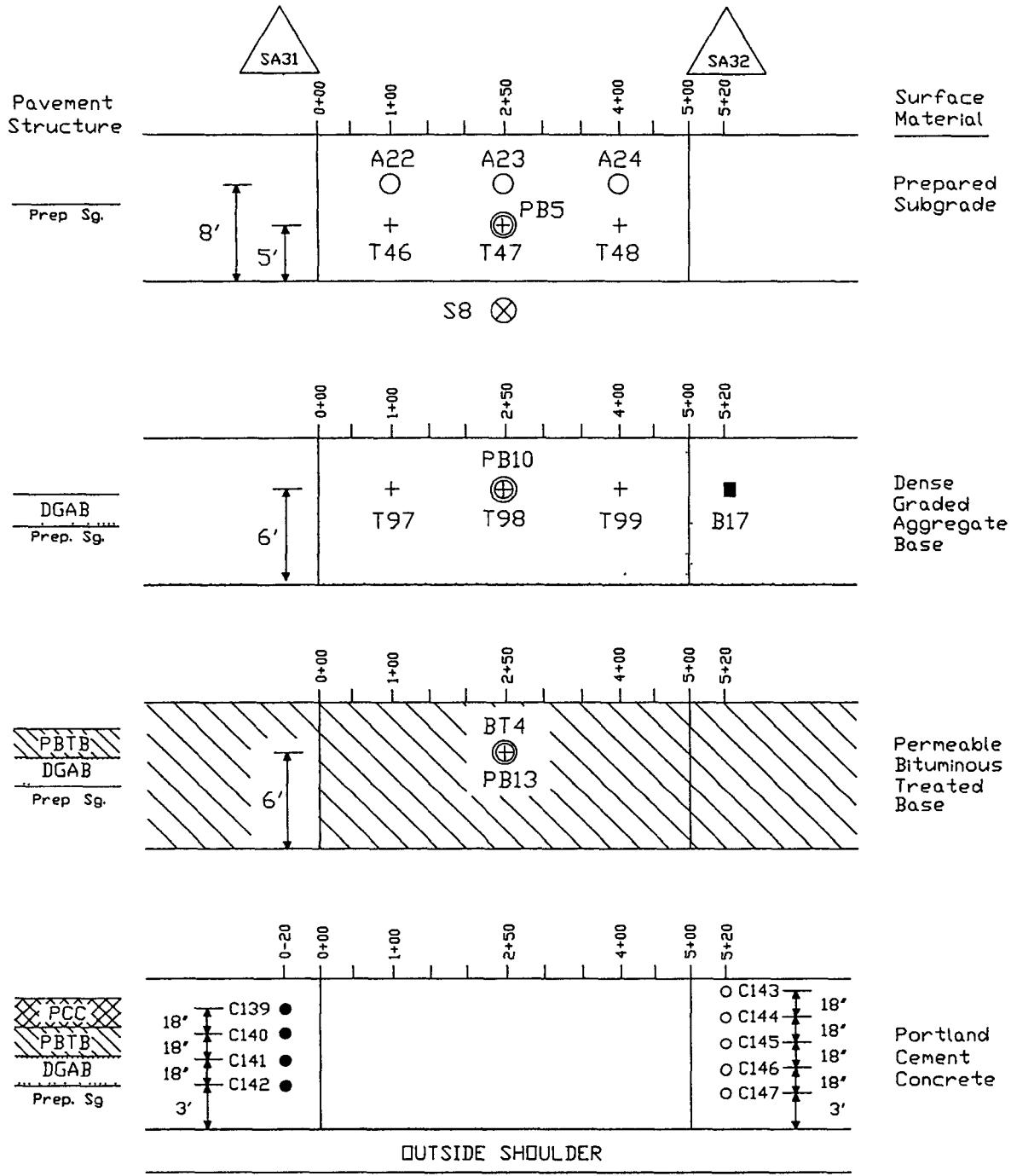
T43-T45 - Nuclear moisture-density tests on Subgrade
 B8 - Bulk sample of Subgrade

T94-T96 - Nuclear moisture-density tests on DGAB

C131-C134 - Cores of PCC surface and PBTB layer

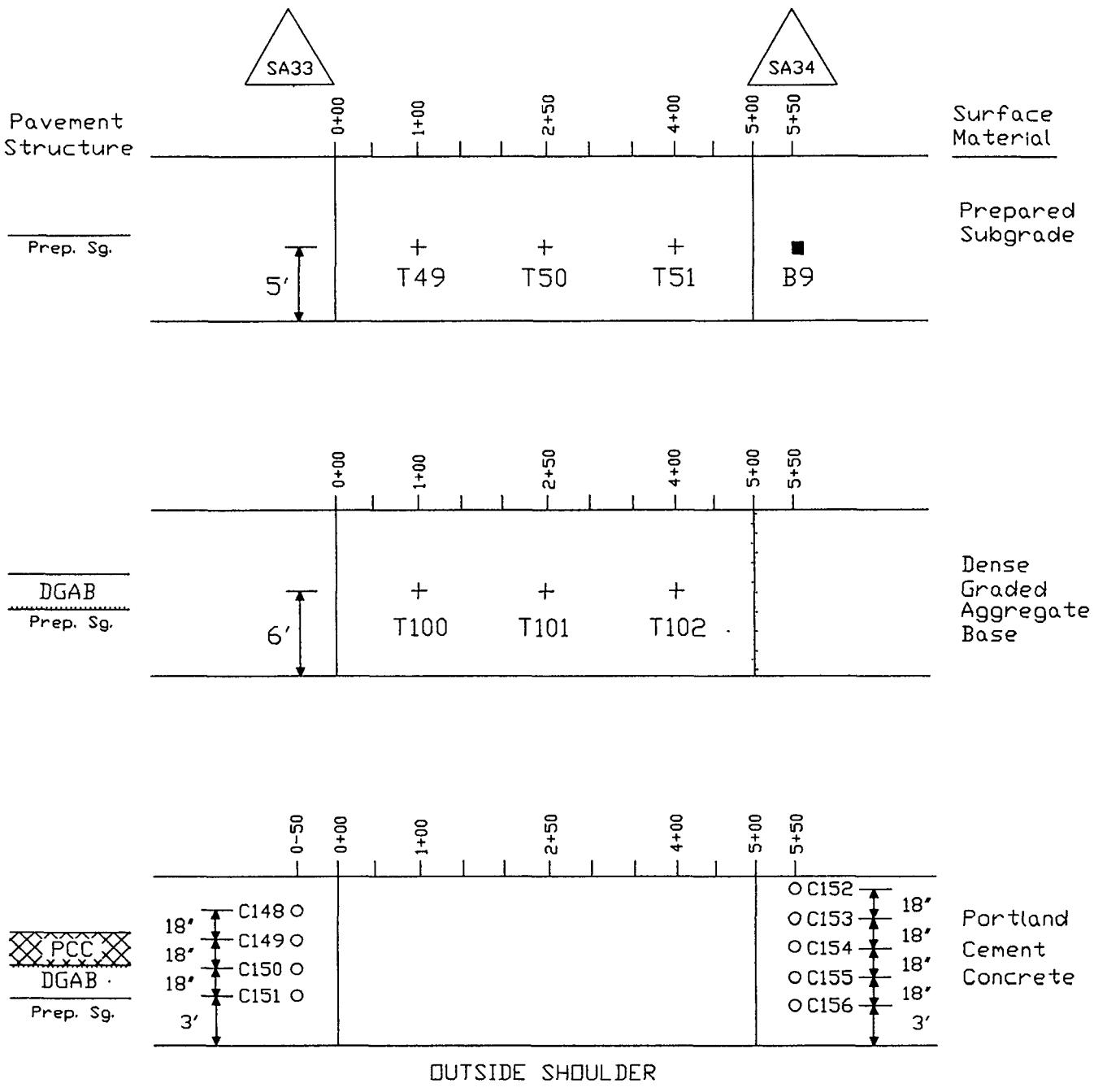
C135-C138 - Cores of PCC surface only

Figure 20. Sampling and test plan for test section 040254 (B35), SPS-2 Arizona.



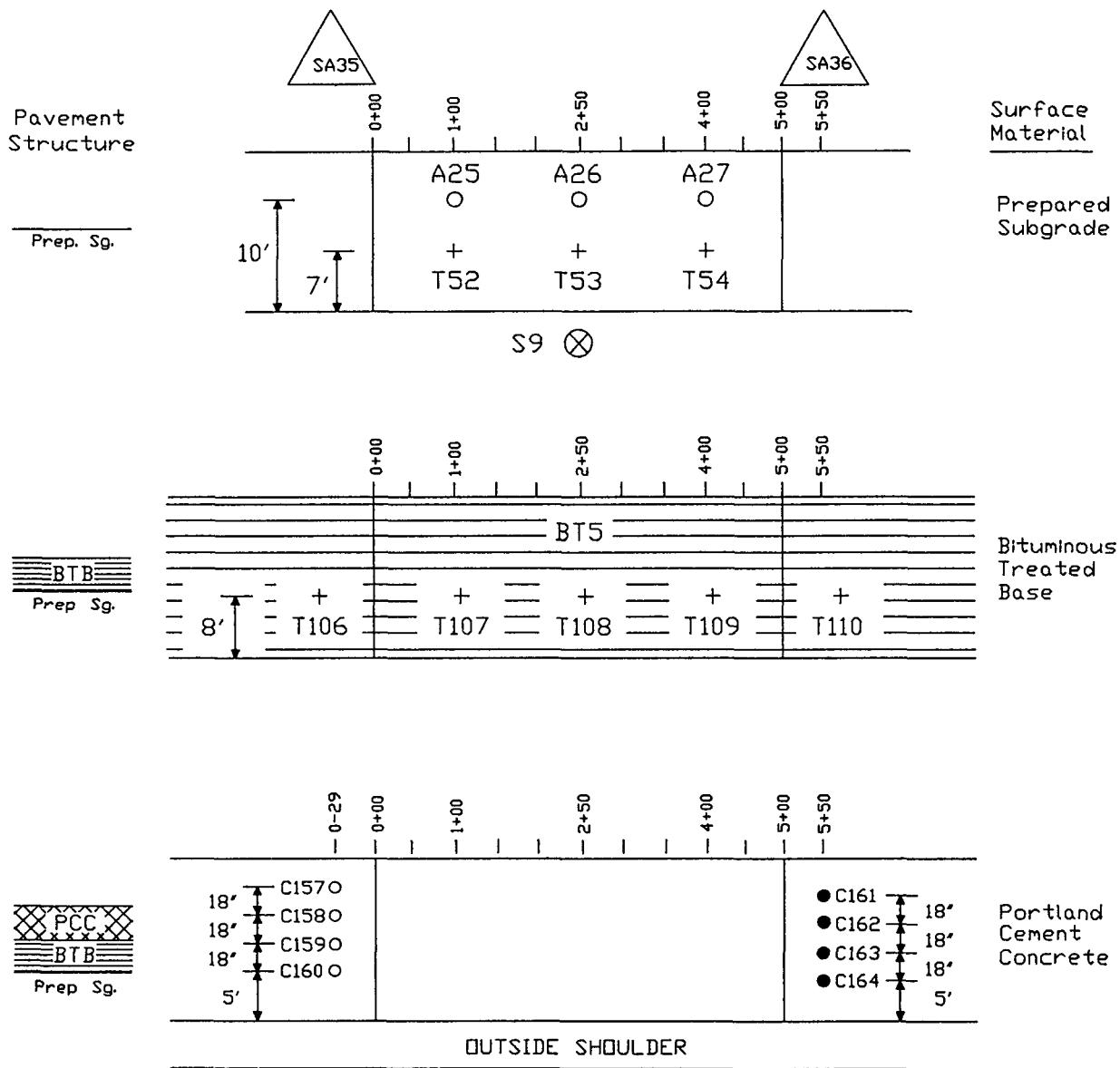
S8 - 20' Shoulder probe
 T46-T48 - Nuclear moisture-density tests on Subgrade
 A22-A24 - Thinwall tube sampling of Subgrade
 T97-T99 - Nuclear moisture-density tests on DGAB
 B17 - Bulk sample of DGAB
 PB5, PB10, PB13, Plate bearing tests
 BT4 - Bulk sample of PBTB
 C139-C142 - Cores of PCC surface and PBTB layer
 C143-C147 - Cores of PCC surface only

Figure 21. Sampling and test plan for test section 040255 (B36), SPS-2 Arizona.



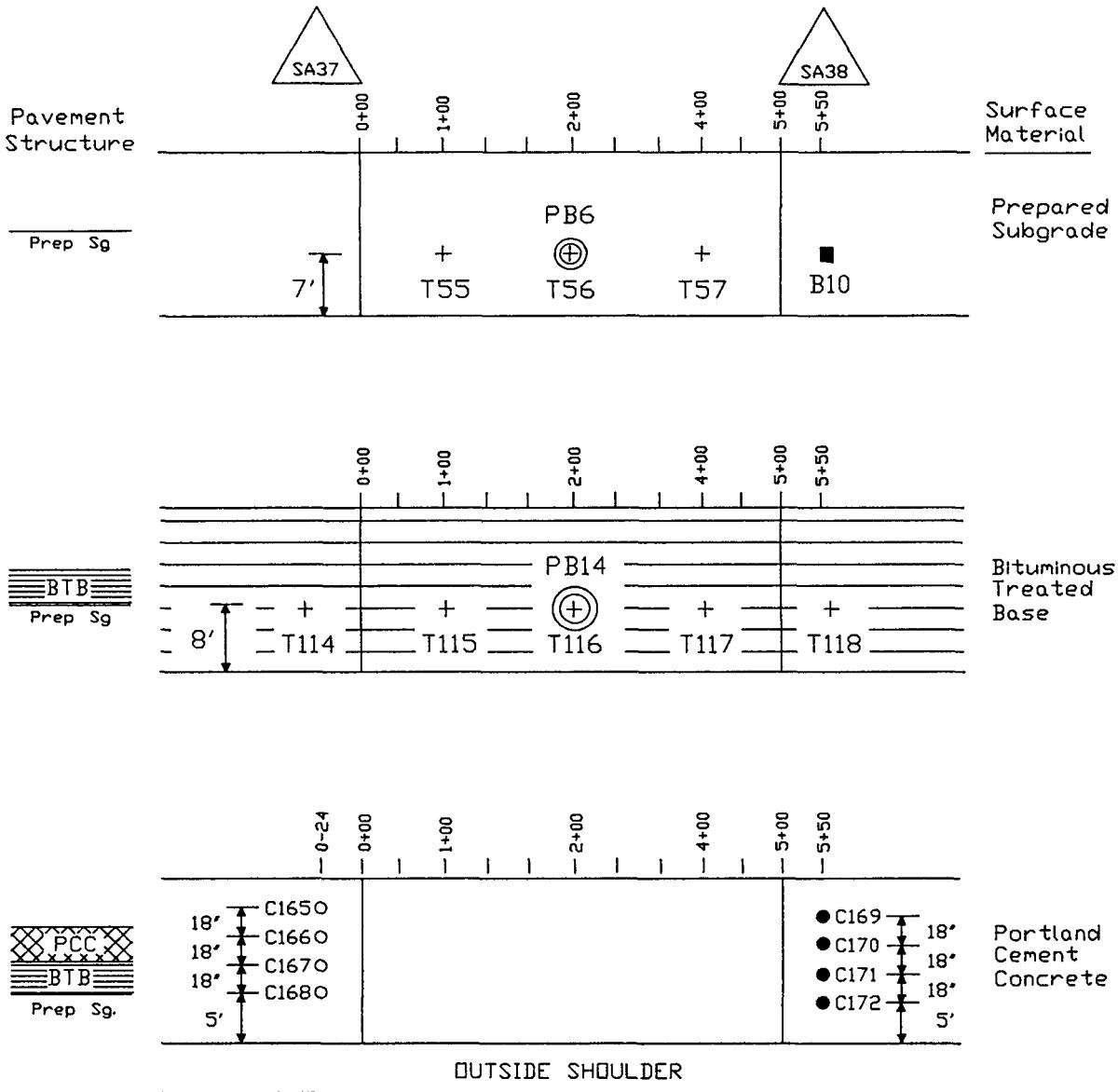
T49-T51 - Nuclear moisture-density tests on Subgrade
 B9 - Bulk sample of Subgrade
 T100-T102 - Nuclear moisture-density tests on DGAB
 C148-C156 - Cores of PCC surface only

Figure 22. Sampling and test plan for test section 040256 (B32), SPS-2 Arizona.



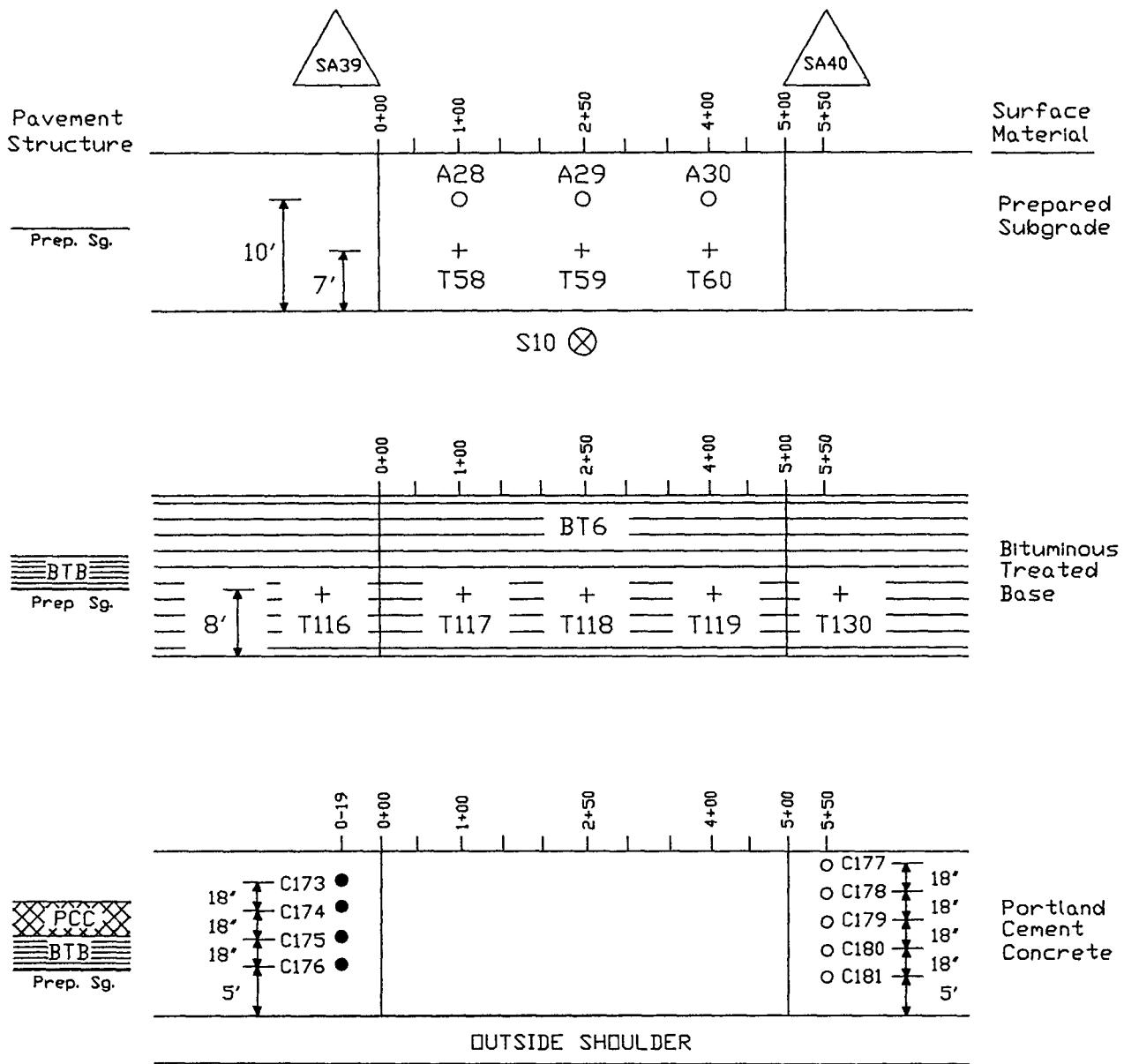
S9 - 20' Shoulder probe
 T52-T54 - Nuclear moisture-density tests on Subgrade
 A25-A27 - Thinwall tube sampling of Subgrade
 T109-T113 - Nuclear density tests on BTB
 BT5 - Bulk sample of BTB
 C157-C160 - Cores of PCC surface only
 C161-C164 - Cores of PCC surface and BTB layer

Figure 23. Sampling and test plan for test section 040257 (AZ21), SPS-2 Arizona.



T55-T57 - Nuclear moisture-density tests on Subgrade
 B10 - Bulk sample of Subgrade
 PB6, PB14 - Plate bearing tests
 T111 - T115 - Nuclear density tests on BTB
 C165-C168 - Cores of PCC surface only
 C169-C172 - Cores of PCC and BTB layer

Figure 24. Sampling and test plan for test section 040258 (AZ22), SPS-2 Arizona.



S10 - 20' Shoulder probe

T58-T60 - Nuclear moisture-density tests on Subgrade

A28-A30 - Thinwall tube sampling of Subgrade

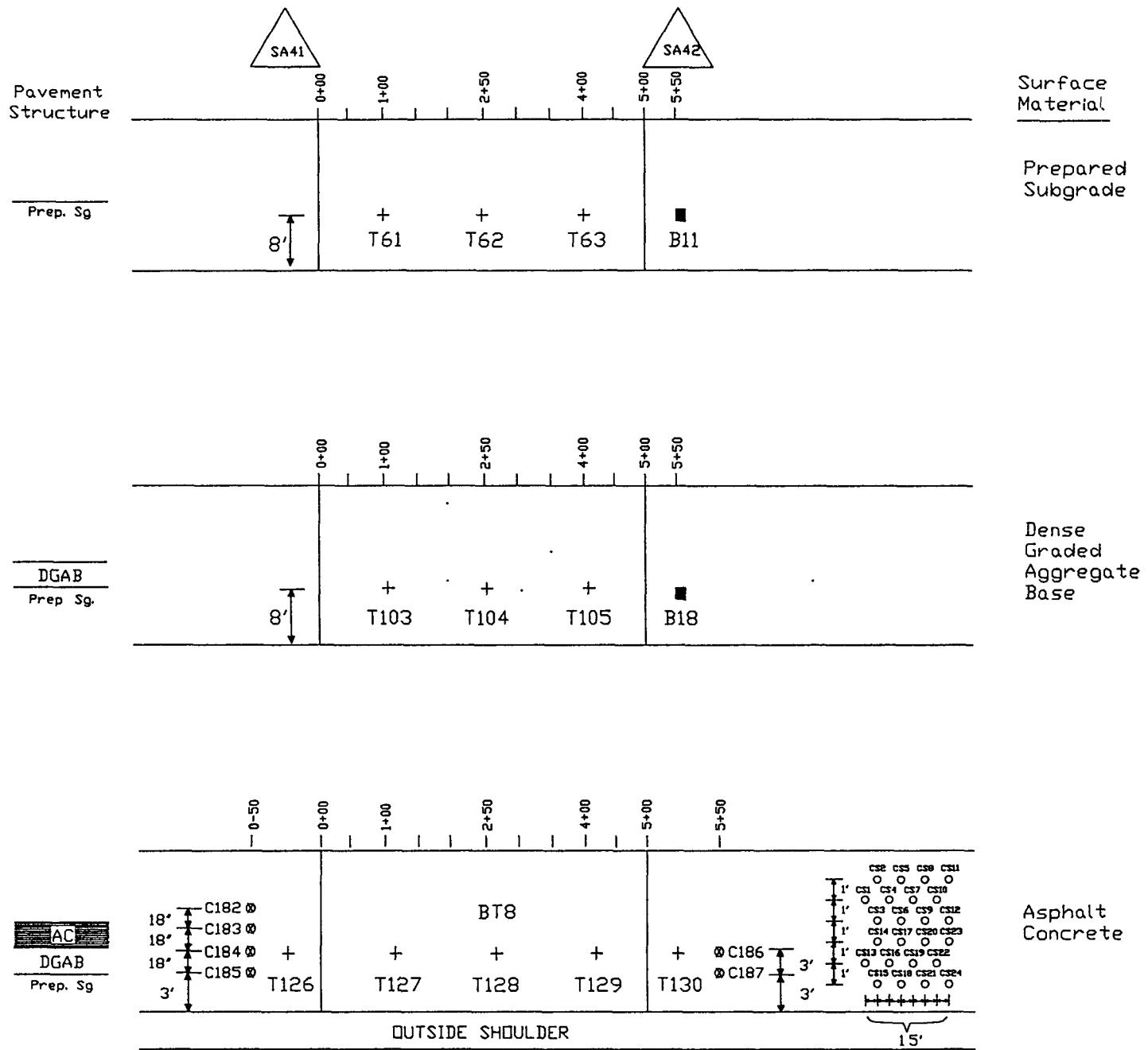
BT6 - Bulk sample of BTB

T116-T120 - Nuclear density tests on BTB

C173-C176 - Cores of PCC surface and BTB layer

C177-C181 - Cores of PCC surface only

Figure 25. Sampling and test plan for test section 040259 (AZ23), SPS-2 Arizona.



T61-T63 – Nuclear moisture-density tests on Subgrade
 B11 – Bulk sample of Subgrade

T103-T105 – Nuclear moisture-density tests on DGAB

B18 – Bulk sample of DGAB

T126-T130 – Nuclear moisture-density tests on AC

C182-C187 – Cores of AC surface only

BT8 – Bulk sample of AC

CS1-CS24 – Cores of AC surface for SHRP asphalt program

Figure 26. Sampling and test plan for test section 040260 (AZ24), SPS-2 Arizona.